APPENDICES

APPENDIX A – 30% CONCEPT DRAWINGS

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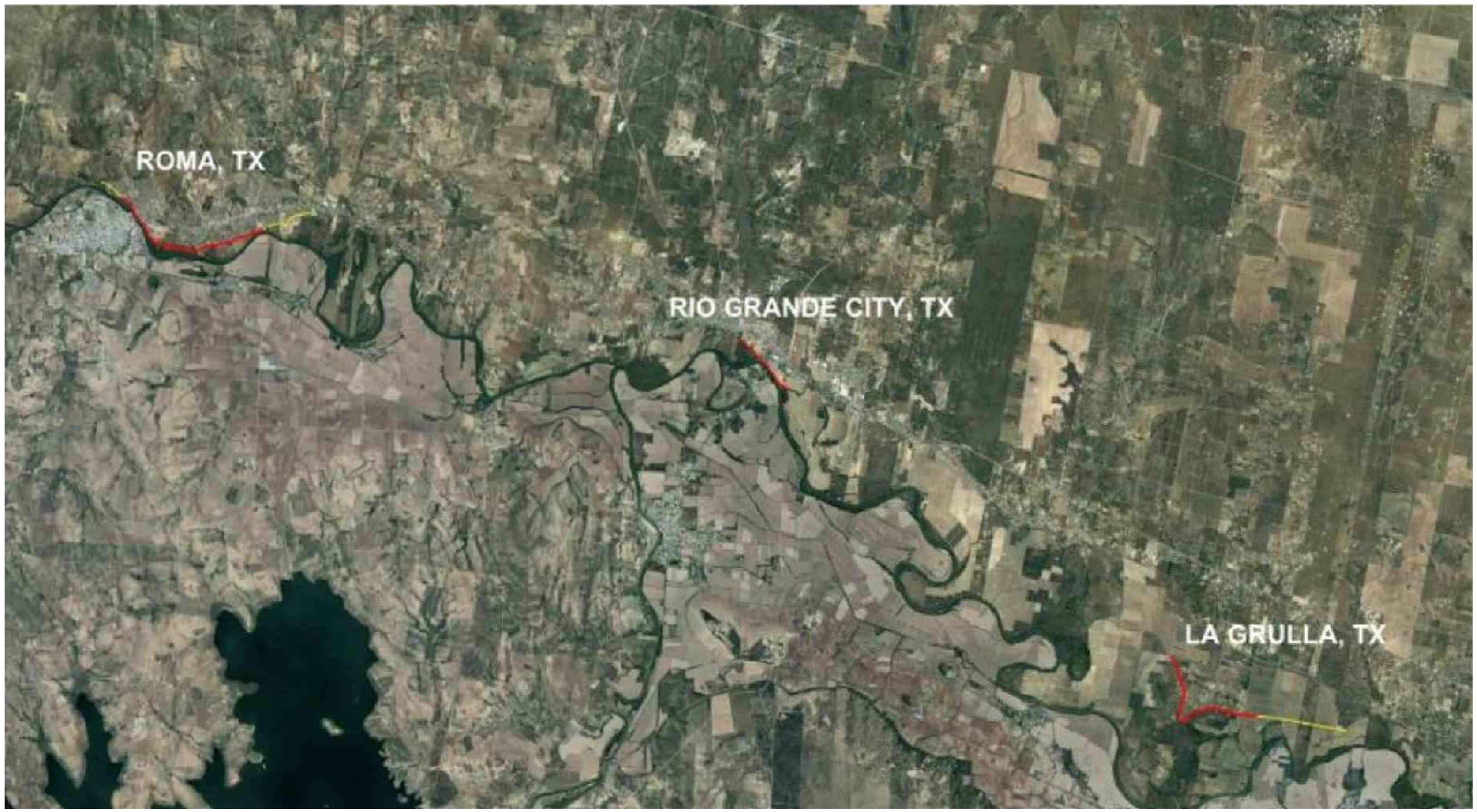
RGV 06 - BORDER INFRASTRUCTURE CONSTRUCTION PROJECT
RIO GRANDE VALLEY (RGV) CONSTRUCTION OF BOLLARD FENCE



ROMA, TEXAS
SOLICITATION NO.:

US Army Corps of Engineers ®

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RGV 06 - BORDER INFRASTRUCTURE CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV) CONSTRUCTION OF BOLLARD FENCE

PROJECT LOCATION

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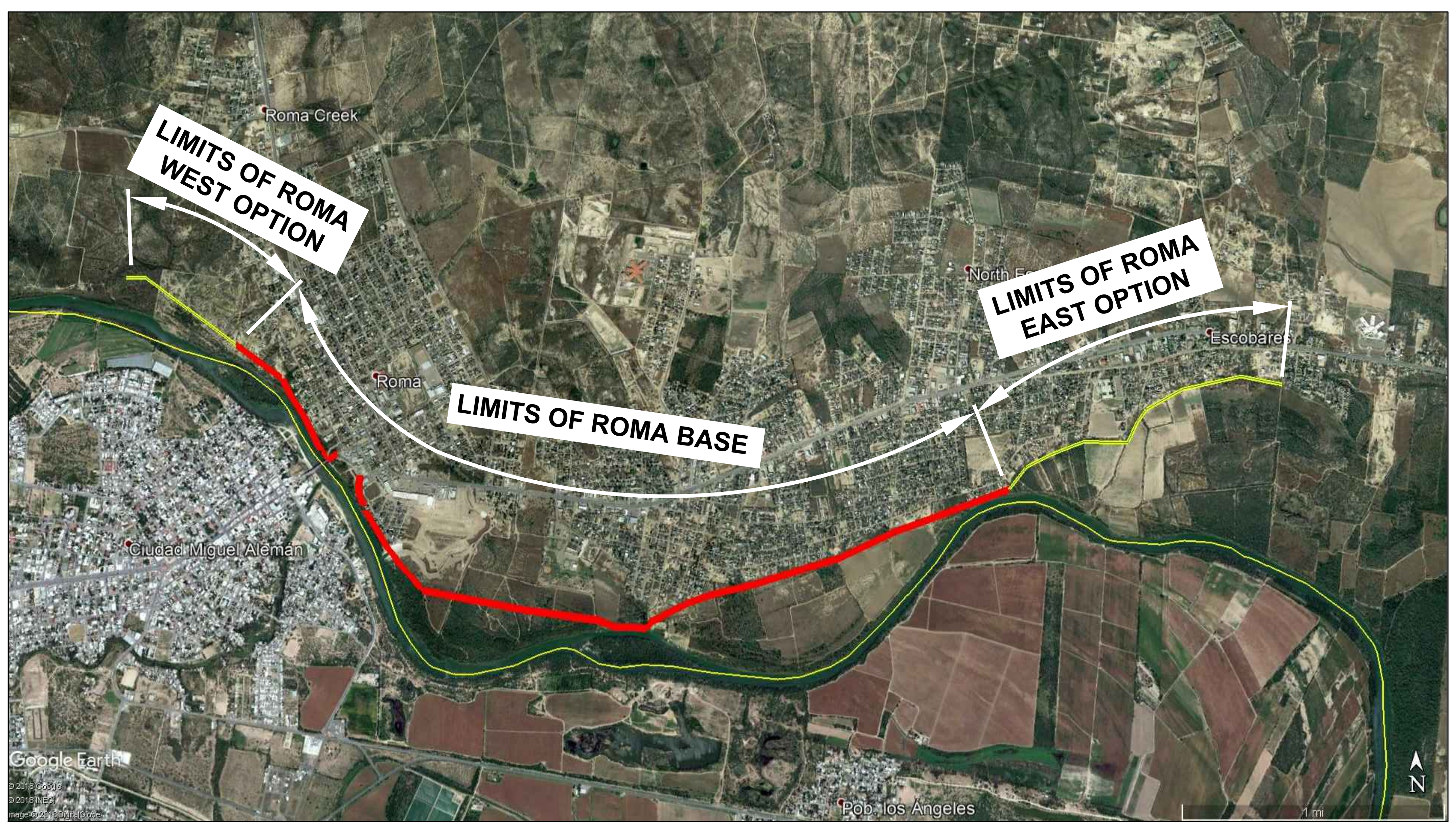
RGV 06 - BORDER INFRASTRUCTURE CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV) CONSTRUCTION OF BOLLARD FENCE ROMA WEST OPTION, BASE AND EAST OPTION



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SOLICITATION NO.:

CONTRACT NO.:

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INDEX

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CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

COVER SHEET

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GENERAL ABBREVIATIONS

NOTE: NOT ALL ABBREVIATIONS INDICTED MAY APPEAR ON THESE DRAWINGS

BOTTOM	BOT
CENTERLINE	CL
CORRUGATED METAL PIPE	CMP
COLUMN	COL
CONCRETE	CONC
DIAMETER	DIA
DOWEL	DWL
DRAWINGS	DWG(S)
EACH WAY	EW
ELEVATION	EL
ELECTRICAL	ELEC
EDGE OF PAVEMENT	EP
EXPANSION	EXP
FIRE HYDRANT	FH
FLOWLINE	FL
GALVANIZED	GALV
GATE VALVE	GV
GUTTER	G
HORSEPOWER	HP
HORIZONTAL	HORIZ
INSIDE DIAMETER	ID
IRON ROD	IR
LEFT	LT
MANHOLE	MH
MAXIMUM	MAX
MINIMUM	MIN
MISCELLANEOUS	MISC
NUMBER	#
NUMBER	NO
ON CENTER	OC
OUTSIDE DIAMETER	OD
PAVEMENT	PVMT
POINT OF CURVATURE	PC
POINT OF INTERSECTION	PI
POINT OF TANGENCY	PT
POLYVINYL CHLORIDE	PVC
RADIUS	R
REMOVE	REMOV
REINFORCING	REINF
REINFORCED CONCRETTE PIPE	RCP
RIGHT	RT
RIGHT OF WAY	ROW
SANITARY	SAN
SCHEDULE	SCHED
SECTION	SECT
SILT FENCE	SF
STAINLESS STEEL	SS
STORM WATER POLLUTION PREVENTION	SWPP
SPECIFICATIONS	SPECS
STORM	STM
SEWER	SEW
TOP	T
TOP OF	T/
TYPICAL	TYP
UNLESS OTHERWISE NOTED	UON
VARIES	VAR
VERTICAL	VERT
WITH	W/
WELDED WIRE FABRIC	WWF

GENERAL SYMBOLS LIST

	BREAK LINE
	TREE LINE
Cx	OVERHEAD COMMUNICATION LINE
Cx	UNDERGROUND COMMUNICATION LINE
SDx	STORM DRAINAGE LINE
	WATER OR IRRIGATION LINE (24" & SMALLER LINE)
x	EXISTING BARBED WIRE FENCE
E E	EXISTING ELECTRIC (OVERHEAD)
E E	ELECTRIC (UNDERGROUND)
O	OIL OR PETROLEUM LINE
	TELEPHONE LINE
Wx	EXISTING WATER LINE
	SURVEY CONTROL MONUMENT
	SIGN
	DITCH
	DITCH CENTER LINE
	ROADWAY
RW	ENFORCEMENT ZONE LINE
	EDGE OF EXISTING ASPHALT
	FIRE HYDRANT
	DOWN GUY
	TELEPHONE/SIGNAL PULL BOX
	PROPERTY CORNER
	CULVERT
	PULL BOX FOR POWER/CONTROL
	PULL BOX FOR TELEPHONE/INSTRUMENTATION
	POSSIBLE KEY PAD LOCATION
	GATE PIER FOUNDATION
R.O.W.	RIGHT-OF-WAY
	TRAFFIC FLOW PATTERN
	EXISTING RETAINING WALL
	PROPOSED GATE
	EXISTING BORDER FENCE CORNER
31	EXISTING CONTOUR
34	PROPOSED CONTOUR
	PROPOSED BOLLARD FENCE
SF	SILT FENCE
MAIL	MAILBOX
GP	GUARD POST (BOLLARD)
	BOREHOLE
PP/XFMR	POWER POLE WITH TRANSFORMER
PIPE	VERTICAL PIPE
CDC	COMMUNICATION DROP CONNECTION
C-RISER	COMMUNICATION RISER
C-UNG	UNDERGROUND COMMUNICATION MARKER
CAM	SECURITY CAMERA
	UTILITY POLE
EDC	ELECTRIC DROP CONNECTION
	GROUND ROD
	LIGHT
	LIGHT POLE
XXX	ELECTRIC METER
	ELECTRIC PANEL
S	SWITCH
J	JUNCTION BOX
WV	WATER VALVE
W	WATER METER
IV	IRRIGATION VALVE
	EVERGREEN TREE
	DECIDUOUS TREE
	ASPHALT ROADWAY
	CONCRETE
	AGGREGATE ROADWAY

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CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

ABBREVIATIONS AND SYMBOLS LIST

SHEET ID
ROMA
G-002

XX% PRELIMINARY DESIGN (NOT FOR CONSTRUCTION)

GENERAL:

1. ANY AND ALL DAMAGE TO EXISTING ROADS, CONCRETE LINED DITCH, FENCE UTILITIES AND ALL OTHER EXISTING STRUCTURES RESULTING FROM THE CONTRACTOR'S CONSTRUCTION SHALL BE REPLACED AND REPAIRED TO ORIGINAL CONDITION OR BETTER AND TO THE SATISFACTION OF THE COR AT THE EXPENSE OF THE CONTRACTOR.

2. IF MATERIALS, QUANTITIES, STRENGTHS OR SIZES INDICATED BY THE DRAWING OR SPECIFICATIONS ARE NOT IN AGREEMENT WITH THESE NOTES, THE BETTER QUALITY AND / OR GREATER QUANTITY, STRENGTH OR SIZE INDICATED, SPECIFIED, OR NOTED SHALL BE PROVIDED.

3. IT IS SOLELY THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE ERECTION PROCEDURE AND SEQUENCE TO INSURE THE SAFETY OF THE STRUCTURE AND ITS COMPONENT PARTS DURING ERECTION. THIS INCLUDES, BUT NOT LIMITED TO,THE ADDITION OF WHATEVER TEMPORARY BRACING, SHORING, GUYS OR TIE-DOWNS THAT MAY BE NECESSARY. SUCH MATERIAL SHALL BE REMOVED AND SHALL REMAIN THE PROPERTY OF THE CONTRACTOR AFTER COMPLETION OF THE PROJECT.

4. THE CONTRACTOR , AT HIS OWN EXPENSE, SHALL RESPOND TO COMPLAINTS REGARDING DUST AND NOISE POLLUTION RESULTING FROM HIS WORK.

5. THE CONTRACTOR SHALL PROVIDE SAFE ACCESS TO AND FROM ALL DRIVEWAYS AND STREETS, PAVED OR UNPAVED, AT ALL TIMES DURING CONSTRUCTION.

6. THE CONTRACTOR SHALL VERIFY AND CHECK ALL DIMENSIONS, LOCATIONS, ELEVATIONS AND DETAILS SHOWN ON THESE DRAWINGS PRIOR TO START OF CONSTRUCTION. ANY UNCERTAINTIES AND DISCREPANCIES SHALL BE IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE CONTRACTING OFFICER FOR CLARIFICATION PRIOR TO COMMENCING THAT WORK FEATURE..

7. THE PROJECT SHALL BE SECURED AT ALL TIMES DURING CONSTRUCTION.

8. THE CONTRACTOR SHALL DISPOSE OF ALL CONSTRUCTION DEBRIS AND OTHER WASTE MATERIAL OFF THE GOVERNMENT OWNED LAND AT AN APPROVED OFF-SITE DISPOSAL AREA IN ACCORDANCE WITH APPLICABLE REGULATORY AGENCY REQUIREMENTS. ALL PERMITS REQUIRED FOR OFF-SITE DISPOSAL SHALL BE OBTAINED BY THE CONTRACTOR.

9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COMPLIANCE WITH AND THE ENFORCEMENT OF ALL APPLICABLE SAFETY REGULATIONS, ACCORDING TO EM 385-1-1 SAFETY AND HEALTH REQUIREMENTS MANUAL.

10. IN CASE OF DISCREPANCY BETWEEN THE SPECIFICATIONS AND CONSTRUCTION DOCUMENTS, THE MORE STRINGENT SHALL APPLY.

11. DURING CONSTRUCTION, STRUCTURE MAY BE BUOYANT. IN THE EVENT OF FAILURE OF DEWATERING SYSTEM AND THE EXCAVATION BECOMES FLOODED OR THE SURROUNDING GROUND BECOMES SATURATED. THE CONTRACTOR SHALL SUBMIT A PLAN TO PREVENT FLOATING OF THE STRUCTURE.

12. ALL WORK SHALL BE COMPLETED TO THE SATISFACTION OF THE USACE, DHS AND USIBWC.

13. THE CONTRACTOR SHALL PRESERVE AND PROTECT OR REMOVE (WITH PRIOR WRITTEN APPROVAL OF AFFECTED PROPERTY OWNER'S) ALL TREES, SHRUBS, HEDGES, RETAINING WALLS. LANDSCAPING, BUILDINGS, WALKS,ETC.,. IN OR NEAR CONSTRUCTION AREA. CONTRACTORS SHALL TRIM AND / OR CUT AS NECESSARY ANY TREE OR BRANCH WITHIN OR EXTENDING INTO THE ENFORCEMENT ZONE IN ORDER TO PROVIDE A CLEAR ZONE.

14. INTERMITTENT SURVEY MONUMENTS MAY BE UNCOVERED DURING FENCE REMOVAL THAT ARE NOT SHOWN ON THE PLANS. THESE MONUMENTS SHALL BE PROTECTED IN PLACE. REALIGN FENCE AROUND MONUMENT TO CLEAR CONCRETE MONUMENT FOOTING (3 FEET OFFSET NOT REQUIRED).

15. THE CONTRACTOR SHALL NOT HAVE CONTACT WITH PRIVATE PROPERTY OWNERS WITHOUT SPECIFIC APPROVAL FROM USACE & CBP. THE CONTRACTOR SHALL COORDINATE WITH PRIVATE LANDOWNERS TO MAINTAIN ACCESS TO PRIVATE PROPERTY DURING CONSTRUCTION. RIGHT OF ENTRY WILL BE PROVIDED AT CONTRACT AWARD.

16. CONTRACTOR MAXIMUM SPEED THROUGH THE CONSTRUCTION FOR BORDER PATROL MUST ALWAYS BE ALLOWED.

17. UNOBSTRUCTED ACCESS THROUGH THE CONSTRUCTION FOR BORDER PATROL MUST ALWAYS BE ALLOWED.

18. CONTRACTOR SHALL HIRE A PROFESSIONAL GEOTECHNICAL ENGINEER TO PROVIDE INSPECTION OF EXCAVATIONS AND SOIL/GROUNDWATER CONDITIONS THROUGHOUT CONSTRUCTION. THE GEOTECHNICAL ENGINEER IS RESPONSIBLE FOR PERFORMING PRE-CONSTRUCTION AND PERIODIC SITE VISITS THROUGHOUT CONSTRUCTION TO ASSESS THE SITE CONDITIONS. ALL COMMUNICATION WITH THE CONTRACTOR WILL BE COORDINATED WITH AND THROUGH THE CONTRACTING OFFICER OR COR TO CHANGE OR CLARIFY THE CONTRACT DOCUMENTS. THE CONTRACTOR WILL BE REQUIRED TO PROVIDE 24-HOUR ADVANCE NOTICE TO THE COR AS WELL AS A WRITTEN SUMMARY REPORT TO COR, WITH REGARD TO ANY SITE VISIT THAT IS COMPLETED BY THE CONTRACTOR'S GEOTECHNICAL ENGINEER.

19. ALL UTILITIES LOCATIONS ARE APPROXIMATE AND TO BE VERIFIED BY THE CONTRACTOR. IT IS THE CONTRACTOR'S RESPONSIBILITY TO IDENTIFY AND LOCATE ALL EXISTING UNDERGROUND AND OVERHEAD UTILITIES PRIOR TO THE START OF DESIGN CONSTRUCTION.

20. CONTRACTOR SHALL MAINTAIN ALL BARBED WIRE FENCES STANDING AT ALL TIMES AND SHALL REPAIR OR REPLACE IF DAMAGED AT CONTRACTOR'S EXPENSE. CONTRACTOR SHALL CLOSE ALL OPEN AREAS WHERE FENCE IS REMOVED WITH BARBED WIRE TO PREVENT CATTLE CROSSING ON THE BORDER. CONTRACTOR SHALL GUARANTEE THAT NO CATTLE WILL CROSS INTO THE US DURING CONSTRUCTION.

21. ALL BORDER MONUMENTS SHALL BE PROTECTED IN PLACE.

22. DESIGN LOADS
WIND LOAD:
- BASIC WIND SPEED 116 MPH
- EXPOSURE C

EARTHQUAKE DESIGN DATA
- SPECTRAL RESPONSE ACCELERATION. Ss 0.044
- SPECTRAL RESPONSE ACCELERATION. S1 0.013
- SITE CLASS D
- SPECTRAL RESPONSE ACCELERATION. SDS 0.044
- SPECTRAL RESPONSE COEFFICIENT. SD1 0.023
- SEISMIC DESIGN CATEGORY. SD1 A

23. THE CONTRACTOR'S TRAFFIC CONTROL PLAN SHALL CONFORM TO THE MORE STRINGENT REQUIREMENT(S) OF TXDOT AND EM385-1-1 REQUIREMENTS.

DEMOLITION AND STRUCTURAL STEEL REMOVAL:

1. THE CONTRACTOR SHALL REMOVE AND DISPOSE OF ALL ITEMS CALLED FOR IN THE PLANS AT AN APPROVED OFF-SITE LOCATION.

2. SEE SECTION 02 41 00 DEMOLITION FOR ADDITIONAL INFORMATION.

3. AT SEVERAL LOCATIONS, ITEMS, SUCH AS BUT NOT LIMITED TO TRAFFIC SIGNS AND MEMORIAL ITEMS, ARE ATTACHED TO THE EXISTING FENCING. IF SUCH ITEMS ARE NOT REMOVED BY LOCAL AUTHORITIES PRIOR TO FENCE DEMOLITION CONTRACTOR SHALL REMOVE SUCH ITEMS AND TURN THEM OVER TO THE COR.

4. AT ALL WASHES, WASH NUMBER SIGNS THAT ARE WELDED TO EXISTING FENCING SHALL BE REMOVED AND TURNED OVER TO COR TO GIVE BORDER PATROL. CONTRACTOR SHALL COORDINATE THROUGH COR WITH BORDER PATROL TO PLACE BACK ONTO NEW FENCE.

CLEARING AND GRUBBING:

1. PRIOR TO GENERAL SITE GRADING, AREAS TO RECEIVE NEW STRUCTURES SHALL BE STRIPPED OF ANY EXISTING STRUCTURES AND VEGETATION.

2. CONTRACTOR SHALL BE RESPONSIBLE FOR TRIMMING AND REMOVAL OF TREE OBSTRUCTING FENCE REPLACEMENT. FOR TREES ROOTED IN MEXICO THAT REQUIRE TRIMMING, CONTRACTOR SHALL COORDINATE WITH THE COR PRIOR TO CONDUCTING WORK.

3. WASTE MATERIALS INCLUDING VEGETATION, ROOTS, CONCRETE, SLURRY AND DEBRIS SHALL BE DISPOSED OF OFF-SITE BY CONTRACTOR.

EXISTING UTILITIES:

1. LOCATIONS OF UNDERGROUND UTILITIES ARE FROM BEST INFORMATION AVAILABLE AT THE TIME THESE PLANS WERE PREPARED. THE GOVERNMENT DOES NOT WARRANT THE ACCURACY OF THE INFORMATION AVAILABLE AT THE TIME THESE PLANS WERE PREPARED. THE GOVERNMENT DOES NOT WARRANT THE ACCURACY OF THE INFORMATION PROVIDED, ANY DEVIATION SHALL BE CALLED TO THE ATTENTION OF THE COR PRIOR TO PROCEEDING WITH WORK IN THE AREA OF FOUND UTILITIES.

2. APPROXIMATE LOCATIONS OF KNOWN EXISTING UTILITIES ARE SHOWN. CONTRACTOR SHALL DETERMINE THE EXACT HORIZONTAL AND VERTICAL LOCATIONS IN THE FIELD PRIOR TO COMMENCING WORK. CONTRACTOR TO BE FULLY RESPONSIBLE FOR DAMAGES WHICH MIGHT OCCUR BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE EXISTING UTILITIES AND /OR STRUCTURES.

3. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO HAVE ALL UTILITIES LOCATED AND MARKED PRIOR TO THE START OF CONSTRUCTION. ANY FOUND UTILITIES NOT STATED ABOVE SHALL BE BROUGHT TO THE ATTENTION OF THE COR FOR DIRECTION, PRIOR TO PROCEEDING WITH CONSTRUCTION IN THE AREA OF SAID UTILITIES.

4. PUBLIC AND PRIVATE UTILITY LINES AND CUSTOMER SERVICE LINES MAY EXIST THAT ARE NOT SHOWN ON THE CONSTRUCTION DRAWINGS. IT SHALL BE CONTRACTOR'S RESPONSIBILITY TO LOCATE, MAINTAIN AND PROTECT THE INTEGRITY OF THESE LINES. HAND EXCAVATION MAY BE REQUIRED.

5. CONTRACTOR SHALL COORDINATE WITH THE APPROPRIATE UTILITY COMPANY TO RELOCATE OR DIVERT ANY UTILITY IN CONFLICT WITH PROPOSED CONSTRUCTION SO AS NOT TO DISRUPT SERVICE OF IT. CONTRACTOR SHALL RESTORE, RELOCATED OR DIVERT UTILITY TO ITS ORIGINAL CONDITION AND LOCATION WHEN APPLICABLE UPON COMPLETION OF CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO MAKE ALL UTILITY ADJUSTMENTS AND ACQUIRE ALL REQUIRED PERMITS FOR RELOCATION.

6. THE VERIFIED LOCATIONS OF ALL UTILITIES SHALL BE DEPICTED ON THE WORKING RECORD DRAWINGS AND FINAL AS-BUILT DRAWINGS.

7. CONTACT FREDDY GUERRA, ASSITANT CITY MANAGER, (956) 849-1411 FOR UTILITY LOCATES WITHIN THE LIMITS OF CONSTRUCTION.

DRAINAGE:

6. CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ADEQUATE DRAINAGE AT ALL TIMES DURING CONSTRUCTION OF PROPOSED FACILITIES.

7. CONTRACTOR SHALL PROVIDE POSITIVE DRAINAGE AT ALL TIMES DURING THE INSTALLATION OF THE STRUCTURES AND DRAINAGE IMPROVEMENTS.

SWPPP:

1. IMPLEMENT SWPPP AS REQUIRED BY TCEQ REQUIREMENTS AND PROJECT SPECIFICATIONS PRIOR TO CONSTRUCTION IMPLEMENT BEST MANAGEMENT PRACTICES (BMPS) DESCRIBED IN THE SWPPP TO REDUCE EROSION. SEE SECTION 01 57 19 ENVIRONMENTAL CONTROLS.

2. THE CONTRACTOR SHALL ENSURE THAT BMPS ARE IN PLACE PRIOR TO AND DURING CONSTRUCTION OF THE FENCE. THE CONTRACTOR IS RESPONSIBLE TO ENSURE THAT EROSION AND SEDIMENT CONTROL MEASURES COMPLY WITH FEDERAL, STATE AND LOCAL REGULATIONS.

3. THE CONTRACTOR SHALL PROVIDE ONE SWPPP REPORT AND PLANS FOR CONSTRUCTION OF THE BASE BID AND OPTION ITEMS. PRIOR TO START OF CONSTRUCTION, THE CONTRACTOR SHALL OBTAIN A NOTICE OF INTENT AND COMPLETE THE NOTICE OF ENDING UPON COMPLETION.

4. THE COR RESERVES THE RIGHT TO REQUIRE THE CONTRACTOR TO MODIFY OR REVISE THE SWPPP TO ENSURE THAT ALL CURRENT MEASURES TO PREVENT OFF-SITE MIGRATION OF POLLUTANTS, INCLUDING SOILS, ARE INCLUDED IN THE SWPPP, IF SWPPP DOES NOT ADEQUATELY ADDRESS APPLICABLE BMPS OR IF THE CONTRACTING OFFICER DETERMINES THAT THE STORM WATER POLLUTION PREVENTION REQUIREMENTS ARE NOT BEING MET.

TUNNELS:

1. IN THE EVENT THAT AN UNDERGROUND TUNNEL OR VOID IS DISCOVERED DURING EXCAVATION, THE DESIGN - BUILD CONTRACTOR SHALL IMMEDIATELY CONTACT THE COR AND BORDER PATROL. THE DESIGN - BUILD CONTRACTOR SHALL INCLUDE THE LOCATION(S) AND DIMENSIONS OF ANY TUNNELS DISCOVERED ON BOTH THE WORKING RECORD DRAWINGS AND FINAL AS-BUILT DRAWINGS.

2. THE LOCATIONS OF ALL TUNNELS DISCOVERED SHALL BE DEPICTED ON THE WORKING RECORD DRAWINGS AND FINAL AS-BUILT DRAWINGS.

SEDIMENT CONTROL:

1. CONTRACTOR SHALL PROVIDE AND MAINTAIN SEDIMENT CONTROL SERVICES IN ACCORDANCE WITH THE CONTRACT DOCUMENT THROUGH THE TERM OF THE WORK COVERED BY HIS CONTRACT, SEE SECTION 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

ON-SITE FILL:

1. SOIL EXCAVATED FROM THE PROJECT SITE SHALL BE CONSIDERED ON -SITE FILL.

2. ON-SITE FILL REQUIRED TO BRING THE SITE TO GRADE SHALL BE FREE OF VEGETATION AND DEBRIS, AND CONTAIN NO ROCKS OR LUMPS LARGER THAN 3 INCH NOMINAL DIAMETER.

3. EXCAVATED ON-SITE SOILS MEETINGS THE REQUIREMENTS FOR ENGINEERED FILL MAY BE REUSED AS ENGINEERED FILL.

4. EXCAVATED ON-SITE SOILS NOT MEETING THE REQUIREMENTS FOR ENGINEERED FILL MAY BE REUSED FOR FILL WITHIN THE ENFORCEMENT ZONE TO ADJUST GRADE PROVIDED IT DOES NOT CONTAIN ROOTS, ORGANICS, TRASH, DELETERIOUS, UNSUITABLE OR UNSATISFACTORY MATERIAL AS DEFINED BY USIBWC LEVEE CONSTRUCTION GUIDELINES, AND SECTION 31 00 00 EARTHWORK PLAN SPECIFICATIONS, INCLUDING COHESIONLESS MATERIAL (SP SW SM GC GM GP GW)

5. EXCAVATED ON-SITE SOILS NOT MEETING THE REQUIREMENTS FOR ENGINEERED FILL MAY BE MODIFIED / CONDITIONED EITHER THROUGH LIME STABILIZATION OR BLENDING TO MEET THE REQUIREMENTS FOR ENGINEERED FILL AND USED WITHIN THE PROJECT SITE PROVIDED IT DOES NOT CONTAIN ROOTS, ORGANICS, DELETERIOUS OR UNSATISFACTORY MATERIALS AS DEFINED BY USIBWC LEVEE CONSTRUCTION GUIDELINES AND SECTION 31 00 00 EARTHWORK PLAN SPECIFICATIONS. ITS IS ESTIMATED 4% HYDRATED LIME WILL BE REQUIRED TO RAISE THE PH AND CONDITION ON-SITE-HIGH PLASTICITY CLAYS. TESTING WILL BE REQUIRED DURING CONSTRUCTION TO VALIDATE THE ESTIMATE. THE CONTRACTOR SHOULD BE AWARE THAT SOIL PROPERTIES VARY WITHIN THE PROJECT SITE, AND THE QUANTITY OF LIME ESTIMATED TO CONDITION THE ON-SITE SOILS MAY CHANGE.

6. EXISTING CALICHES /AGGREGATE SURFACE COURSE EXCAVATED FROM THE EXISTING ROAD MAY NOT BE REUSED AS AGGREGATE SURFACE COURSE FOR THE NEW PATROL ROAD OR CREST ROAD. EXISTING CALICHE/AGGREGATE SURFACE COURSE MAY BE REUSED AS FILL WITHIN THE ENFORCEMENT ZONE,OR USED AS SUBBASE MATERIAL WITHIN THE PATROL ROAD TO REDUCE THE AGGREGATE SURFACE MATERIAL WITHIN THE PATROL ROAD TO REDUCE THE AGGREGATE SURFACE COURSE REQUIREMENTS. SEE ALL WEATHER ROAD (SEE CIVIL NARRITIVE), PROVIDED IT DOES NOT CONTAIN ROOTS, ORGANICS, DELETERIOUS OR UNSATISFACTORY MATERIAL AS DEFINED BY USIBWC LEVEE CONSTRUCTION GUIDELINES, AND SECTION 31 00 00 EARTHWORK PLAN SPECIFICATIONS.

7. NO ON-SITE FILL SHALL BE PLACED ON OR AGAINST CONCRETE LESS THAN 7 DAYS AFTER PLACEMENT OR 70 PERCENT OF THE DESIGN STRENGTH WITHOUT PRIOR APPROVAL OF THE CONTRACTING OFFICER. CRAWLER-TYPE TRACTORS,VIBRATORY EQUIPMENT AND OTHER SIMILAR COMPACTION EQUIPMENT SHALL NOT BE USED WITHIN 4 FEET OF ANY COMPLETED OR PARTIALLY COMPLETED STRUCTURE. COMPACTION WITHIN 4 FEET OF COMPLETED OR PARTIALLY COMPLETED STRUCTURES SHALL BE ACCOMPLISHED BY THE USE OF MECHANICAL HAND TAMPERS, VIBRATING PLATES, OR OTHER APPROVED METHODS AND EQUIPMENT. FILL MATERIAL SHALL BE COMPACTED TO AT LEAST 95% OF THE MAXIMUM DRY DENSITY WITHIN ±3% OF THE OPTIMUM MOISTURE CONTENT IN ACCORDANCE WITH ASTM D 698. CONTRACTOR WILL ENSURE THAT COMPACTION OPERATIONS DO NOT DAMAGE ANY EXISTING UTILITIES OR STRUCTURE. ANY DAMAGE CAUSED BY THE CONTRACTOR'S OPERATION SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE..

8. FILL PLACED ON ENGINEERED FILL OR NATURAL SLOPES STEEPER THAN 5H:1V SHALL BE KEYED AND BENCHED INTO EXISTING SLOPE. THE BENCHES SHALL BE WIDE ENOUGH TO ACCOMMODATE THE COMPACTION EQUIPMENT AND THE LOWEST BENCH SHALL BE THE WIDEST AT A MINIMUM OF 8 TO 10 FEET WIDE. BENCH HEIGHTS SHALL BE A MAXIMUM OF 3 FEET. BENCH WIDTHS AT THE TOP SHALL BE A MINIMUM OF 4 FEET.

EGRESS/INGRESS ROAD AND STAGING AREAS:

1. THE CONTRACTOR MAY USE THE PUBLIC ROADS SHOWN ON THE LOCATION MAP IN THE PLANS FOR INGRESS / EGRESS TO THE PROJECT SITE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING ANY DAMAGE AT THESE LOCATIONS DUE TO CONSTRUCTION.

2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROCURING AND MAINTAINING THE STAGING AREA.

3. SAFE ACCESS THROUGH WORK SITE SHALL BE MAINTAINED AT ALL TIMES. MATERIAL AND EQUIPMENT SHALL NOT BE STAGED SUCH AS TO LIMIT ACCESS THROUGH THE CONSTRUCTION SITE.

4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROCURING AND MAINTAINING THE STOCKPILE AREA. STOCKPILE AREA WILL BE LOCKED OUTSIDE THE FLOOD PLAIN.

5. THE CONTRACTOR SHALL NOT HAVE CONTACT WITH PRIVATE PROPERTY OWNERS FOR EGRESS/INGRESS ACCESS WITHOUT SPECIFIC APPROVAL FROM USACE AND CBP.

EXCAVATION:

1. ALL EXCAVATED MATERIAL IS TO BE REMOVED FROM THE PROJECT PERMANENT EASEMENTS AND STAGING AREAS AND DISPOSES OF AT AN APPROVED DISPOSAL LOCATION. UNLESS OTHERWISE NOTED OR APPROVED FOR USE AS BACK FILL MATERIAL. EXCAVATED MATERIAL SHALL NOT BE STORED IN THE RIVER FLOOD PLAIN.

2. TRUCKS SHALL BE LOADED IN A MANNER SO AS TO AVOID LOSS OF LOADED MATERIAL OR ANY PORTION THEREOF DURING TRANSPORT IN ACCORDANCE WITH STATE LAW.

3. THE CONTRACTOR SHALL, AT HIS/HER OWN EXPENSE, REPAIR ANY HAUL ROAD SURFACE IRREGULARITIES CAUSES BY LOADING OR HAULING OPERATIONS.

4. ALL TEMPORARY EXCAVATIONS MUST COMPLY WITH APPLICABLE LOCAL, STATE AND FEDERAL SAFETY REGULATION.

PREPARED SUBGRADE:

1. DUE TO THE VARIABILITY OF SITE SOILS, ISOLATED AREAS OF THE SUBGRADE MAY REQUIRE OVER-EXCAVATION AND RECOMPACTION TO MITIGATE LOOSE OR DISTURBED SOIL CONDITIONS. SUBGRADE FOR THE ENTIRE BORDER ROAD SHALL BE PROOF ROLLED IN ACCORDANCE WITH SECTION 31 00 00 EARTHWORK, SUBSECTION 3.12.1 PROOF ROLLING. ANY AREAS OBSERVED TO DEFLECT UNDER THE PRESSURE EXERTED BY THE PROOF ROLLING OPERATIONS WILL REQUIRE OVER-EXCAVATION AND REPLACEMENT WITH ENGINEERED FILL.

2. FOR CUT AREAS, CUT PROPOSED ROAD TO GRADE, SCARIFY TOP 8 INCHES OF SUBGRADE AND MOISTURE CONDITION. FOR FILL AREAS, SCARIFY TOP 6 INCHES OF EXISTING GRADE AND MOISTURE AND CONDITION.

3. COMPACT SUBGRADE FOR CUTTING AREAS TO 95% OF ASTM D1557 AT ±2% OF OPTIMUM MOISTURE CONTENT. FILL MATERIAL SHALL BE TESTED IN 8-INCH LOOSE/ COMPACTED TO 6 INCHES UNDER ROADWAYS AND 12-INCH LOOSE/COMPACTED TO 8-INCHES IN OTHER FILL LOCATIONS AND SHALL CARRY SIMILAR SOIL PROPERTIES AS SHOWN ON BORING LOGS. COMPACTION OF FILL MATERIAL IN SUBGRADE SHALL BE TO 95% OF ASTM D1557 AT ±2% OF OPTIMUM MOISTURE CONTENT.

4. SITE GRADING PERFORMED DURING OR SUBSEQUENT TO WET WEATHER MAY RESULT IN NEAR-SURFACE SITE SOILS WITH MOISTURE CONTENTS SIGNIFICANTLY ABOVE OPTIMUM. THIS CONDITION COULD HAMPER EQUIPMENT MANEUVERABILITY AND EFFORTS TO COMPACT SITE SOILS TO THE RECOMMENDED COMPACTION CRITERIA. DURING MOST OF THE YEAR, THE SITE WILL TYPICALLY DRY TO WORKABLE MOISTURE CONTENTS WITHIN 1 TO 2 DAYS. IF TIME IS CRITICAL FACTOR, DISKING FOR AERATION, CHEMICAL TREATMENT, REPLACEMENT WITH DRIER MATERIAL, STABILIZATION WITH GEOTEXTILE FABRIC OR OTHER METHODS MAY BE IMPLEMENTED TO REDUCE EXCESSIVE SOIL MOISTURE AND FACILITATE EARTHWORK OPERATIONS. THIS WILL BE DONE AT NO ADDITIONAL COST TO THE GOVERNMENT. ALL COMMUNICATION WITH CONTRACTOR SHALL BE COORDINATED WITH AND THROUGH THE COR TO CHANGE OR CLARIFY THE CONTRACT DOCUMENTS. ANY FIELD DIRECTIVES WILL BE COORDINATED WITH AND ISSUED BY THE COR.

FOUNDATIONS:

1. FOUNDATIONS SHALL BE CAST ON PROPERLY COMPACTED SOIL. NATIVE SOILS SHALL BE COMPACTED TO AT LEAST 95% TO THE MAXIMUM DRY DENSITY AT ±2% OF OPTIMUM MOISTURE (ASTM D1557).

2. WHERE NATIVE SOILS ARE LOOSE, SATURATED OR UNSTABLE AND DO NOT MEET THE ALLOWABLE BEARING CAPACITY, NATIVE SOILS SHALL BE OVER-EXCAVATED BELOW THE BOTTOM OF THE FOOTING ELEVATION TO SOIL ELEVATION MEETING THE DESIGN PARAMETERS. THE OVER-EXCAVATED AREAS SHALL BE BACK FILLED AND COMPACTED USING ENGINEERED FILL. SEE SECTION 31 00 00 EARTHWORK FOR ADDITIONAL INFORMATION. SOIL CONDITIONS WILL VARY AND HENCE COMPACTION MUST RELATE TO THE TYPE OF MATERIAL.

3. CONTRACTOR SHALL BE PREPARED TO SHORE AND FORM TRENCH FOOTING WHERE LOOSE SOILS ARE ENCOUNTERED.

4. FOUNDATION DETAILS FOR BOLLARDS NEED TO BE SUBMITTED (AFTER A GEOTECHNICAL STUDY IS COMPLETED). FOUNDATION DETAILS MAY VARY FROM ONE LOCATION TO ANOTHER DEPENDING UPON SOIL TYPE.

5. CONTRACTOR SHALL DEVELOP TRENCH DEWATERING PLANS WHERE NECESSARY PRIOR TO FOUNDATION PLACEMENT.

CAST-IN PLACE CONCRETE:

1. ALL CONCRETE STRENGTH SHALL CONFORM TO SECTION 03 30 00 CAST-IN- PLACE CONCRETE. SEE SECTION 03 30 00 CAST-IN -PLACE CONCRETE FOR ADDITIONAL INFORMATION.

2. CONCRETE WORK TO BE COVERED IN ACCORDANCE WITH "THE BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE" ACI 318.

3. CONTRACTOR SHALL REVIEW ALL DRAWINGS FOR SIZE AND LOCATION OF EMBEDDED ITEMS AND SLEEVES REQUIRED. THESE ITEMS SHALL BE FURNISHED AND INSTALLED PRIOR TO PLACEMENT OF CONCRETE.

4. ALL MIXING, HANDLING AND TRANSPORTING, PLACING AND CURING OF CONCRETE SHALL BE IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE AMERICAN CONCRETE INSTITUTE.

5. THE ONLY PERSONS AUTHORIZED TO ADD WATER TO THE CONCRETE TRUCK AT THE JOB SITE ARE THE QC TESTING REPRESENTATIVE. IF APPROVED, THE QC TESTING REPRESENTATIVE IS REQUIRED TO NOTIFY THE COR AND QA TESTING REPRESENTATIVE.

6. ALL EXPOSED EDGES SHALL BE CAST WITH $\frac{3}{4}$ INCH CHAMFERS UNO.

REINFORCING STEEL:

1. REINFORCING STEEL SHALL CONFORM TO SECTION 03 20 00.00 10 CONCRETE REINFORCING. NO TACK WELDING OF REINFORCING SHALL BE PERMITTED. PLACEMENT AND DETAILING OF CONCRETE REINFORCEMENT AND ACCESSORIES SHALL BE IN ACCORDANCE WITH ACI 318 AND ACI SP-66, RESPECTIVELY (LATEST ADDITIONS).

2. REBAR SHALL HAVE A MINIMUM COVER OF 3 INCHES UNLESS OTHERWISE NOTED.

3. HORIZONTAL AND VERTICAL REINFORCING STEEL SHALL BE CONTINUOUS ACROSS CONSTRUCTION JOINTS.

4. CONSTRUCTION JOINTS NOT INDICATED ON THE DRAWINGS SHALL BE MADE AND LOCATED AS NOT TO IMPAIR SIGNIFICANTLY THE STRENGTH OF THE STRUCTURE. CONTRACTORS SHALL SUBMIT LOCATION OF PROPOSED JOINTS IN THE SLABS AND WALLS TO ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION.

STRUCTURAL STEEL:

1. STRUCTURAL STEEL SHALL BE PROCURED BY THE CONTRACTOR IN ACCORDANCE WITH SECTION 05 12 00 STRUCTURAL STEEL.

2. STRUCTURAL STEEL SHALL CONFORM TO SECTION 05 12 00 STRUCTURAL STEEL. SEE SECTION 05 12 00 STRUCTURAL STEEL FOR ADDITIONAL INFORMATION.

3. WELDED CONNECTIONS FOR STRUCTURAL STEEL SHALL CONFORM TO THE LATEST REVISED CODE OF THE AMERICAN WELDING SOCIETY, AWS D1.4.

4. STRUCTURAL STEEL SHALL CONFORM TO THE AISC "SPECIFICATIONS FOR DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDING", LATEST EDITION.

US Army Corps of Engineers ®

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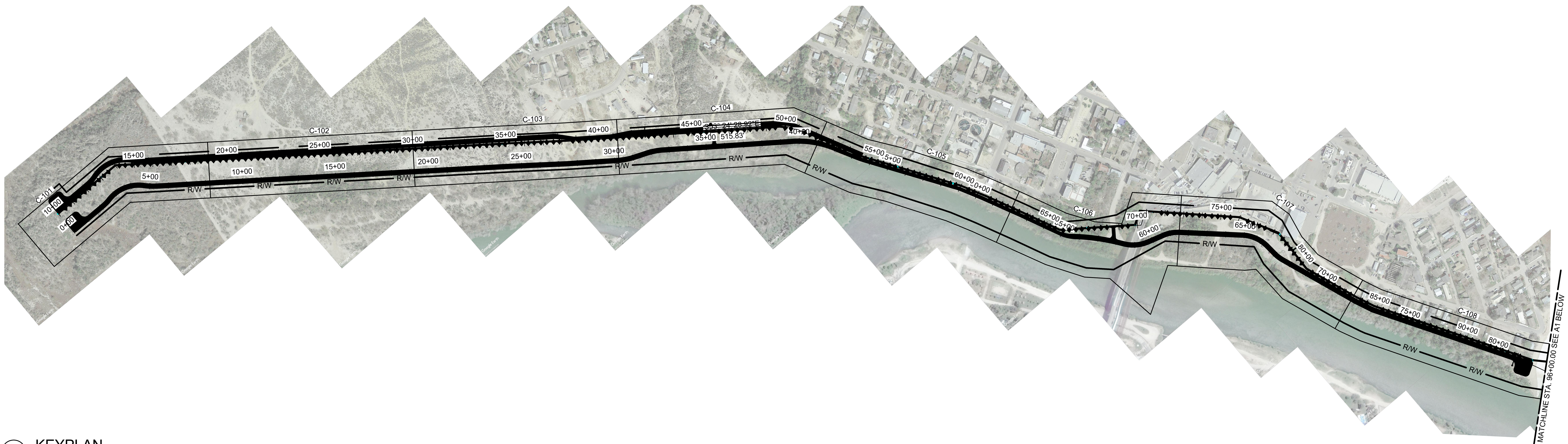
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

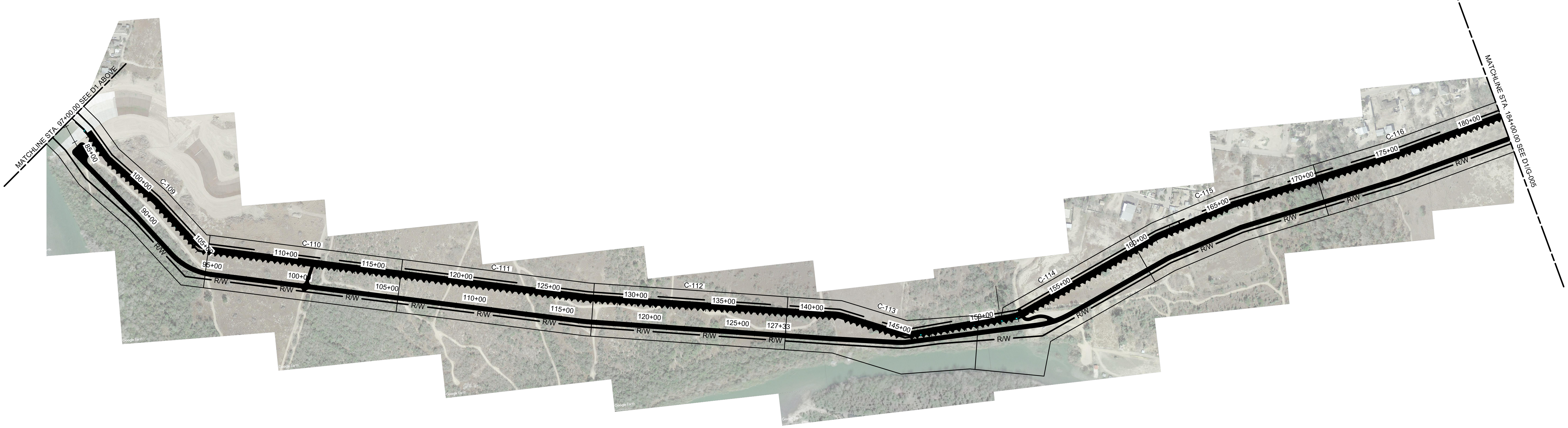
GENERAL NOTES

SHEET ID
ROMA
G-003



D2 KEYPLAN
SCALE: 1" = 300'-0"

0 50 100 1" = 300' - 0"



A1 KEYPLAN
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0 50 100 1" = 300' - 0"

US Army Corps of Engineers ®

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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

KEYPLAN
STA. 10+00.00 - 184+00.00

SHEET ID
ROMA
G-004

D2 KEYPLAN
SCALE: 1" = 300'-0"

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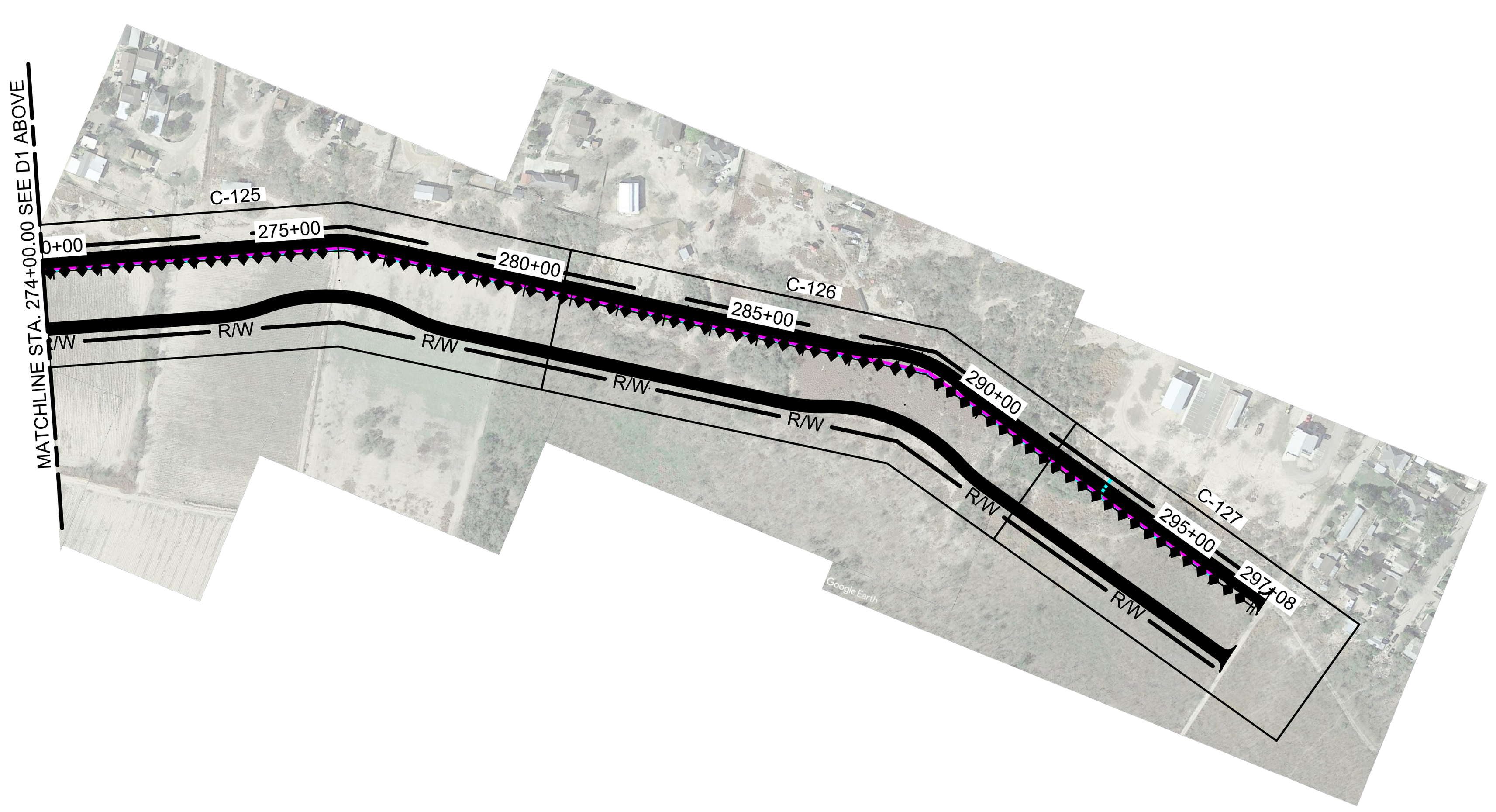

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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

KEYPLAN
STA. 184+00.00 - 299+30.00

SHEET ID
ROMA
G-005

No.	Description	Station	Latitude	Longtitude
1	OPTION WEST BEGIN	10+00.00'	N26° 24' 53.28"	W99° 01' 54.16"
2	PI	14+01.40'	N26° 24' 53.28"	W99° 01' 49.75"
3	PI	33+06.93'	N26° 24' 41.93"	W99° 01' 33.01"
4	PI	35+19.63'	N26° 24' 40.66"	W99° 01' 31.14"
5	OPTION WEST END/ BESE BEGIN	38+24.09'	N26° 24' 38.82"	W99° 01' 28.48"
6	PI	44+05.75'	N26° 24' 35.40"	W99° 01' 23.34"
7	PI	44+56.48'	N26° 24' 35.10"	W99° 01' 22.89"
8	PI	49+72.32'	N26° 24' 32.08"	W99° 01' 18.32"
9	PI	50+67.55'	N26° 24' 31.39"	W99° 01' 17.60"
10	PI	54+43.56'	N26° 24' 28.06"	W99° 01' 15.75"
11	PI	59+96.65'	N26° 24' 23.48"	W99° 01' 12.41"
12	PI	61+27.45'	N26° 24' 22.33"	W99° 01' 11.75"
13	PI	61+52.17'	N26° 24' 22.11"	W99° 01' 11.63"
14	PI	63+61.27'	N26° 24' 20.24"	W99° 01' 10.64"
15	PI	65+81.51'	N26° 24' 18.26"	W99° 01' 09.62"
16	PI	70+18.88'	N26° 24' 15.69"	W99° 01' 05.75"
17	PI	70+94.25'	N26° 24' 16.08"	W99° 01' 05.04"
18	PI	75+98.99'	N26° 24' 12.62"	W99° 01' 01.04"
19	PI	78+22.83'	N26° 24' 10.66"	W99° 00' 59.88"
20	PI	80+68.38'	N26° 24' 08.23"	W99° 00' 59.98"
21	PI	83+81.59'	N26° 24' 05.32"	W99° 00' 58.79"
22	PI	84+72.27'	N26° 24' 04.49"	W99° 00' 58.40"
23	PI	84+90.87'	N26° 24' 04.33"	W99° 00' 58.31"
24	PI	93+58.20'	N26° 23' 56.96"	W99° 00' 53.40"
25	PI	95+84.96'	N26° 23' 55.25"	W99° 00' 51.78"
26	PI	97+69.14'	N26° 23' 53.70"	W99° 00' 50.73"
27	PI	101+30.20'	N26° 23' 51.13"	W99° 00' 47.96"
28	PI	105+04.74'	N26° 23' 48.23"	W99° 00' 45.40"
29	PI	127+28.57'	N26° 23' 43.84"	W99° 00' 21.43"
30	PI	141+55.49'	N26° 23' 41.81"	W99° 00' 05.90"
31	PI	145+49.57'	N26° 23' 40.39"	W99° 00' 01.87"
32	PI	152+03.21'	N26° 23' 41.01"	W98° 59' 54.71"
33	PI	157+96.16'	N26° 23' 43.52"	W98° 59' 48.82"
34	PI	161+19.89'	N26° 23' 44.90"	W98° 59' 45.60"
35	PI	165+78.32'	N26° 23' 46.35"	W98° 59' 40.82"
36	PI	175+17.35'	N26° 23' 48.39"	W98° 59' 30.75"
37	PI	193+66.52'	N26° 23' 53.42"	W98° 59' 11.19"
38	PI	205+97.57'	N26° 23' 58.42"	W98° 58' 58.84"
39	BASE END/ OPTION EAST BEGIN	231+33.44'	N26° 24' 06.80"	W98° 58' 32.56"
40	PI	237+05.48'	N26° 24' 11.14"	W98° 58' 28.51"
41	PI	238+93.43'	N26° 24' 11.98"	W98° 58' 26.66"
42	PI	242+36.93'	N26° 24' 13.44"	W98° 58' 23.25"
43	PI	245+34.19'	N26° 24' 14.55"	W98° 58' 20.22"
44	PI	246+48.29'	N26° 24' 14.88"	W98° 58' 19.02"
45	PI	247+81.81'	N26° 24' 15.39"	W98° 58' 17.67"
46	PI	250+26.56'	N26° 24' 16.17"	W98° 58' 15.12"
47	PI	258+44.63'	N26° 24' 15.87"	W98° 58' 06.12"
48	PI	259+30.74'	N26° 24' 15.82"	W98° 58' 05.18"
49	PI	263+78.07'	N26° 24' 19.75"	W98° 58' 02.92"
50	PI	267+46.33'	N26° 24' 22.65"	W98° 58' 00.45"
51	PI	276+13.45'	N26° 24' 26.64"	W98° 57' 52.01"
52	PI	280+63.85'	N26° 24' 27.52"	W98° 57' 47.15"
53	PI	288+62.75'	N26° 24' 29.10"	W98° 57' 38.54"
54	EAST OPTION END	297+08.42'	N26° 24' 27.36"	W98° 57' 29.44"

B1 FENCE POB, EOP AND PI LOCATIONS

SCALE: NTS

US Army Corps of Engineers ®

MARK | DESCRIPTION | DATE

ISSUED DATE:
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CONTRACT NO.:
FILE NUMBER:

DESIGNED BY: X
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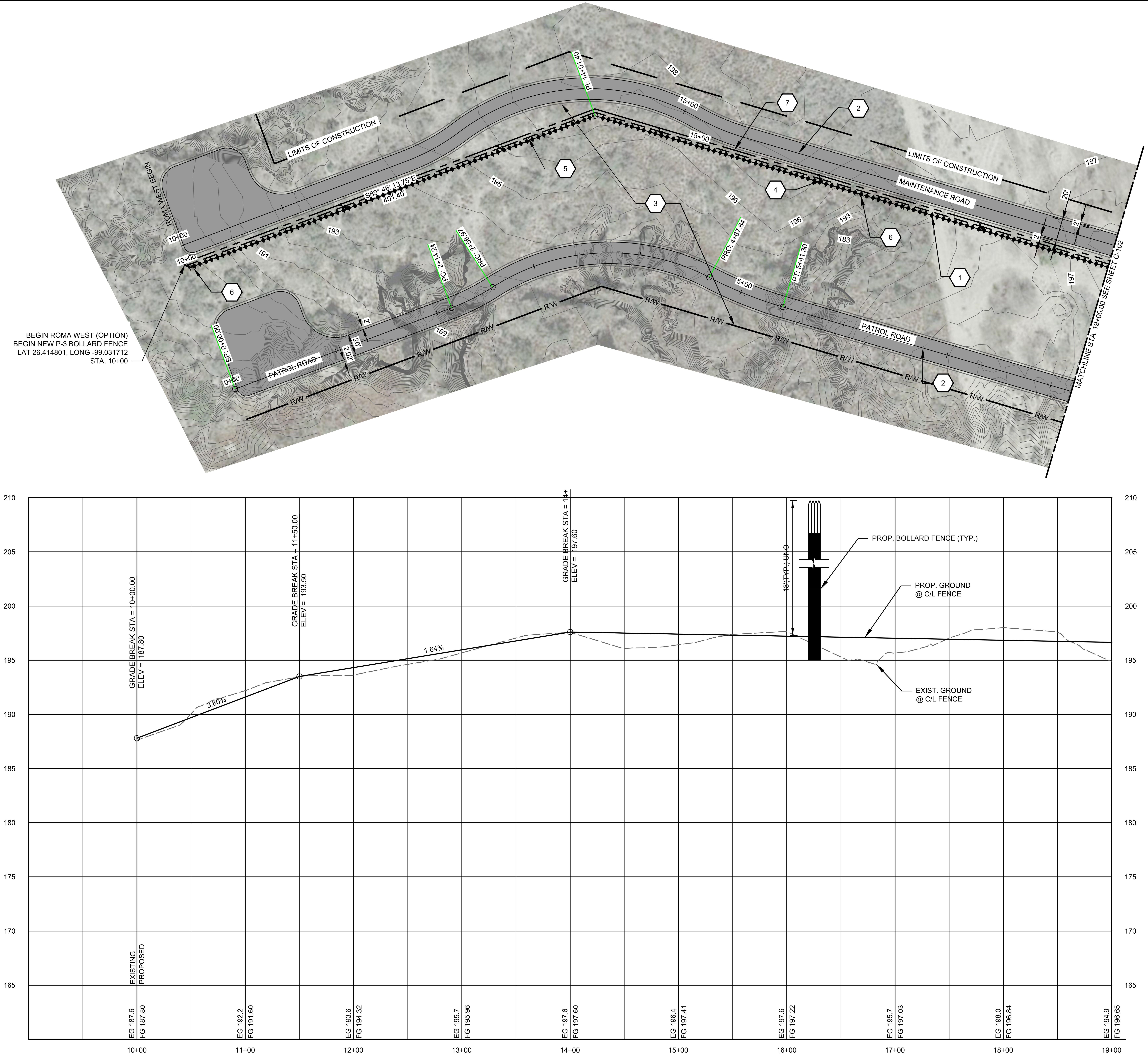
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

FENCE PI LOCATIONS

SHEET ID
ROMA
G-006



A1 PLAN AND PROFILE
SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

GENERAL NOTES

1. THIS SHEET IS AT 35% CONCEPT DESIGN AND NOT TO BE USED FOR CONSTRUCTION.
2. CONTRACTOR IS RESPONSIBLE FOR PERFORMING ALL GEOTECHNICAL TESTING, TOPOGRAPHIC MAPPING, DESIGN, SURVEY STAKE-OUT, ABOVE AND BELOW GROUND UTILITY IDENTIFICATIONS AND REQUIRED RELOCATIONS, AND REMOVAL AND PROPER DISPOSAL OF STRUCTURES, DEBRIS, ETC. LOCATED WITHIN THE ENFORCEMENT ZONE.
3. CONTRACTOR SHALL ENSURE THAT ALL DESIGNS MEET TACTICAL INFRASTRUCTURE STANDARDS, LATEST EDITION.
4. CONTRACTOR SHALL VERIFY LOCATION OF ALL UTILITIES, IRRIGATION CULVERTS AND DRAINAGE STRUCTURES, AND ADJUST/RELOCATE AS REQUIRED TO DE-CONFLICT WITH THE PROPOSED BOLLARD FENCE AND ENFORCEMENT ZONE (I.E.: EX. IRRIGATION VALVES TO BE RELOCATED TO NORTH LEVEE EMBANKMENT).
5. CONTRACTOR SHALL DESIGN AND INSTALL ALL DRAINAGE SYSTEMS FOR THIS PROJECT.
6. LIGHTING LOCATIONS ARE CONCEPTUAL. CONTRACTOR TO PROVIDE FINAL LIGHTING COMPUTATIONS AND LOCATIONS.

XX KEYNOTES

1. PROPOSED NEW TYPE P-3 BOLLARD FENCE.
2. PROPOSED TYPE FC-2 AGGREGATE ALL-WEATHER ROAD.
3. CLEAR VEGETATION AND GRADE WITHIN ENFORCEMENT ZONE.
4. PROPOSED LIGHT POLE, PULLBOX, AND LIGHTING - SEE ELEC. FOR LOCATIONS. (TYP.)
5. PROPOSED POWER AND LIGHTING DISTRIBUTION CABLE AND CONDUIT/DUCTBANK.
6. PROPOSED FENCE GROUNDING LOCATIONS.
7. PROPOSED COMMUNICATION CONDUIT/ DUCTBANK. (CABLE FUTURE BY OTHERS)
8. GATE ELECTRICAL DISTRIBUTION EQUIPMENT.
9. GATE GROUNDING LOCATIONS.
10. PROPOSED MOTORIZED VEHICLE SLIDE GATE.
11. PROPOSED RVSS SITE.
12. CONCEPTUAL ELECTRICAL UTILITY CONNECTION POINT.
13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

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US ARMY CORPS OF ENGINEERS
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GALVESTON, TX 77553-1229

ETEGRA
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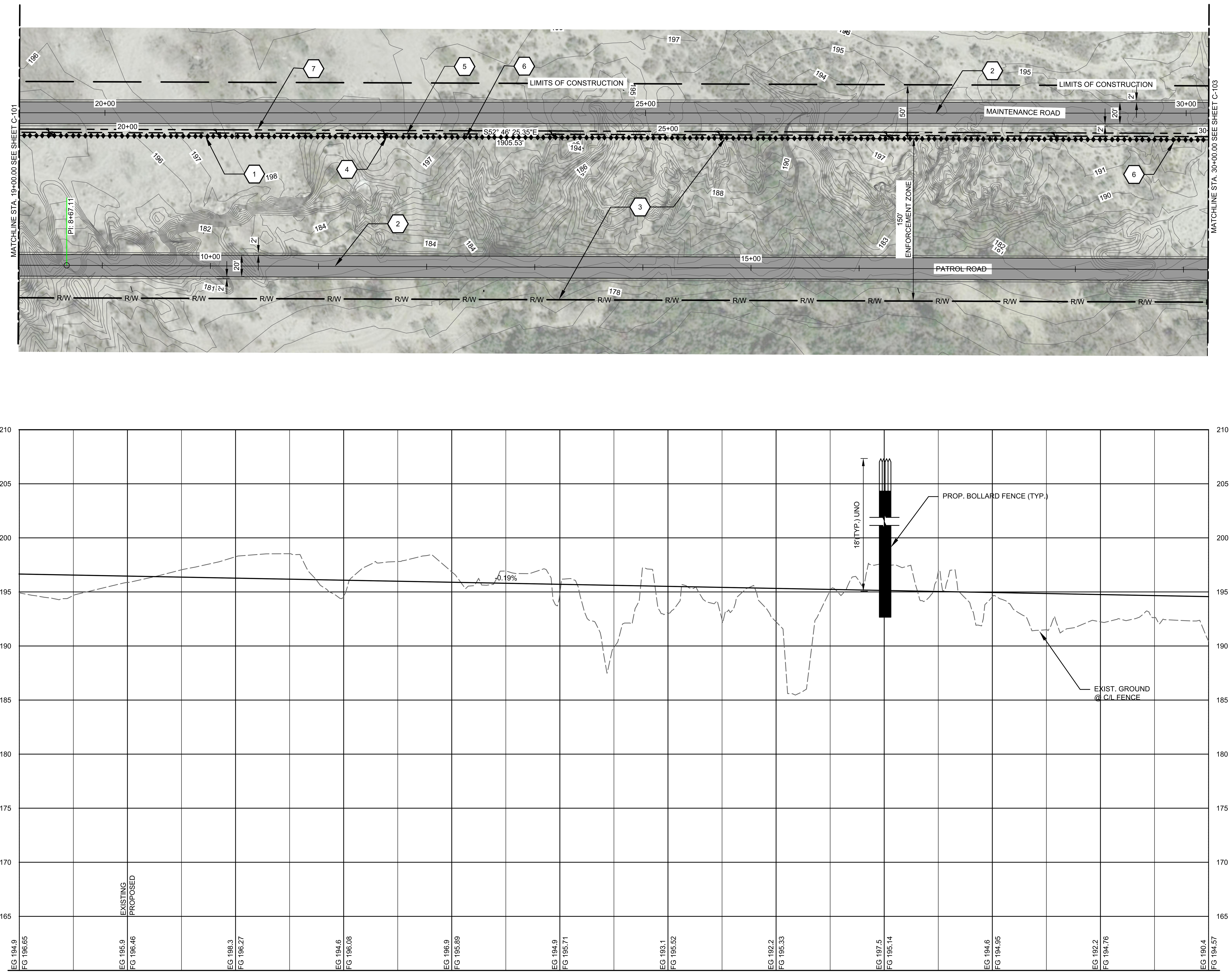
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 10+00.00 - 19+00.00

SHEET ID
ROMA
C-101



A1 PLAN AND PROFILE
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US Army Corps of Engineers ®

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US ARMY CORPS OF ENGINEERS
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ETEGRA
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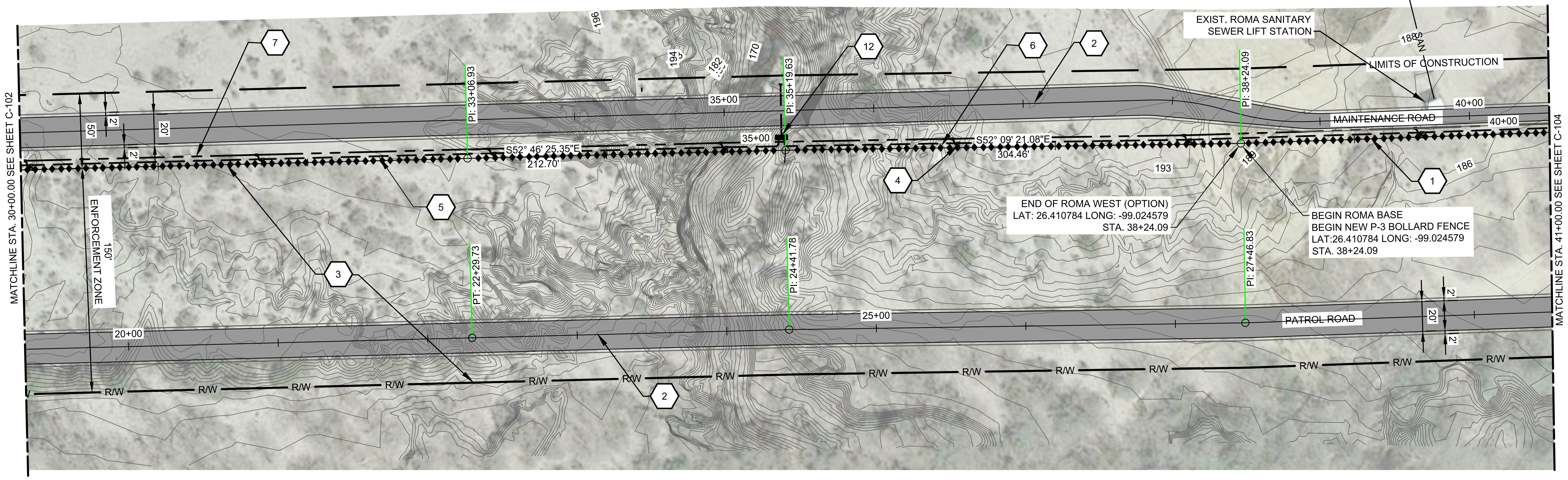
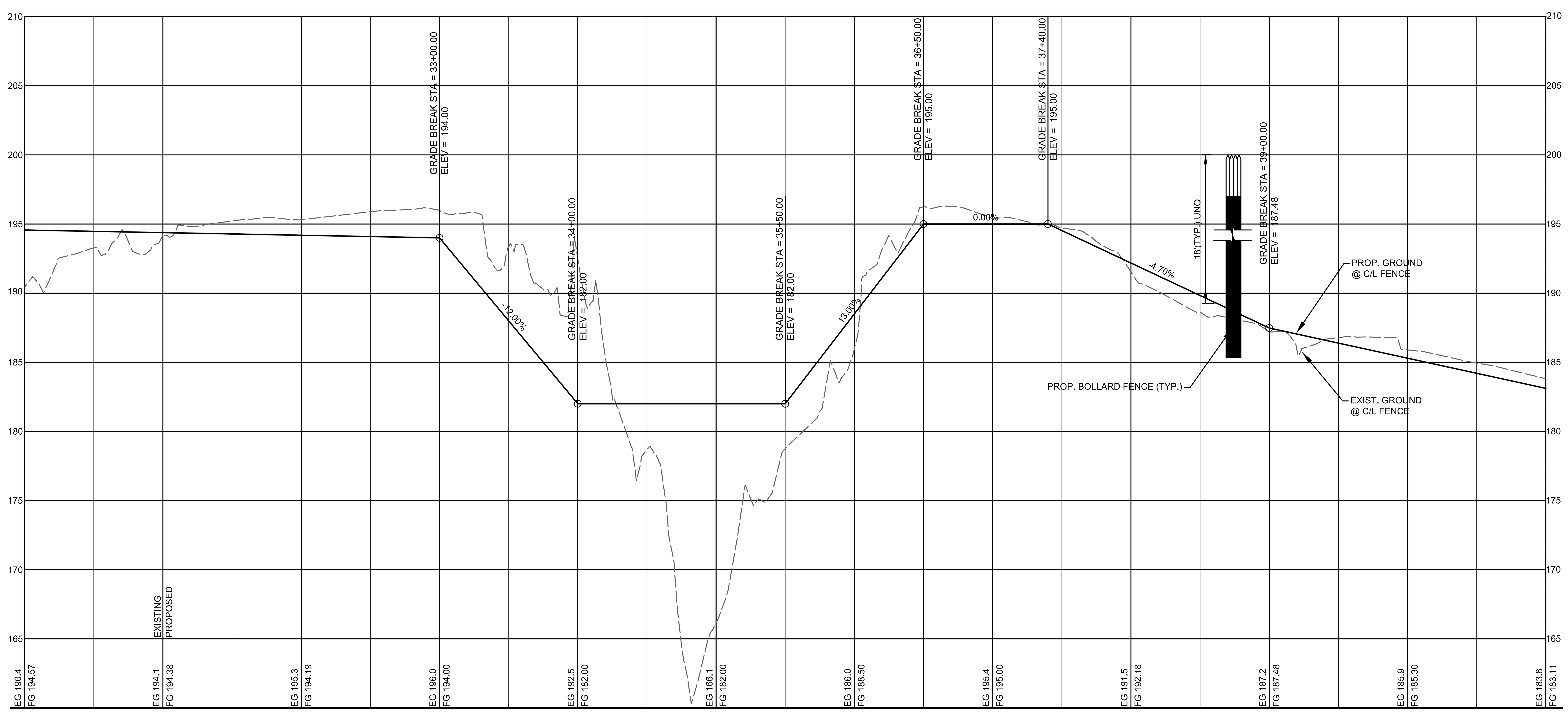
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 19+00.00 - 30+00.00

SHEET ID
ROMA
C-102

APPROXIMATE LOCATION CITY OF ROMA, TEXAS SANITARY SEWER





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US Army Corps of Engineers ®

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GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
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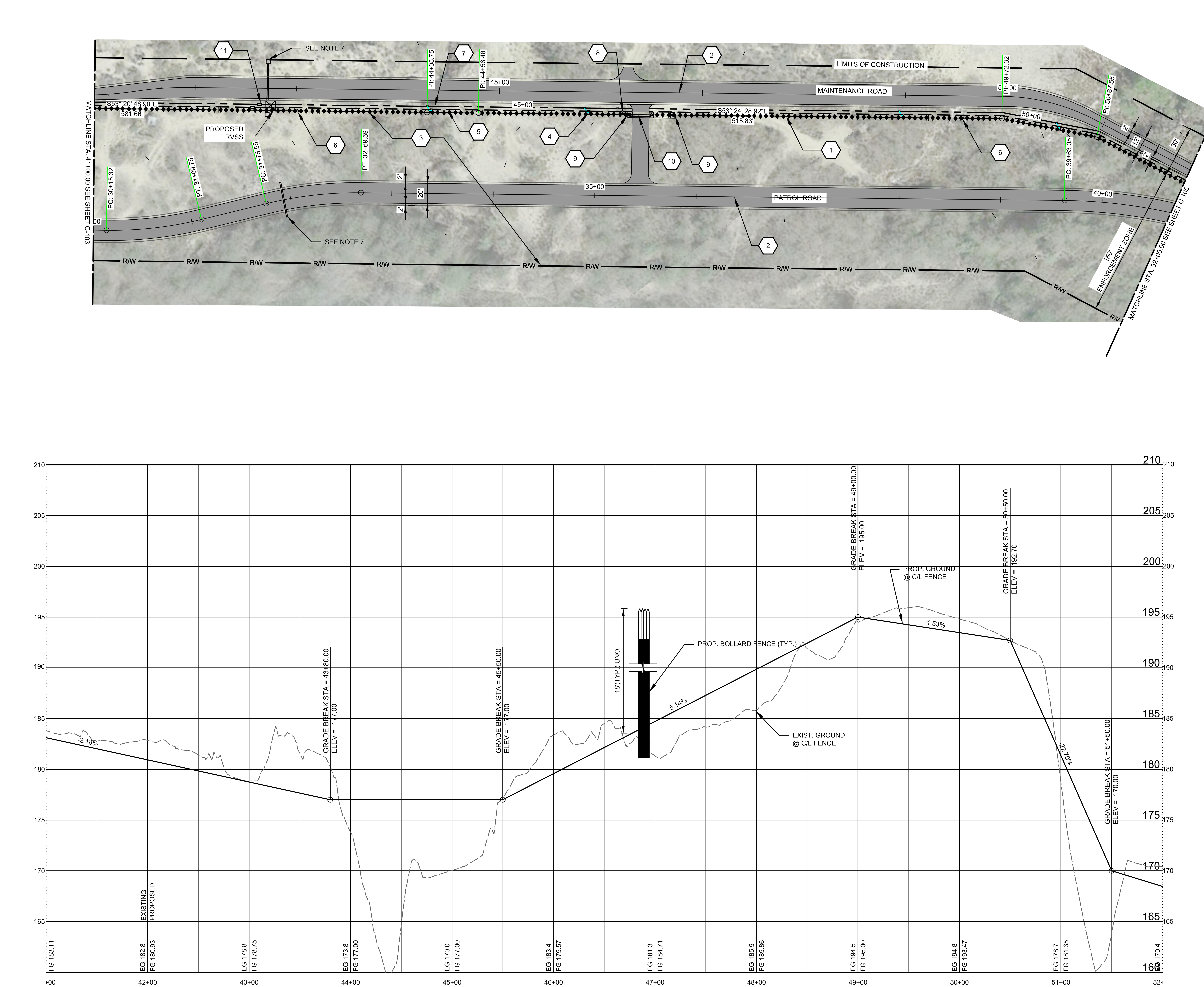
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 30+00.00 - 41+00.00

SHEET ID
ROMA
C-103



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3. CONTRACTOR SHALL ENSURE THAT ALL DESIGNS MEET TACTICAL INFRASTRUCTURE STANDARDS, LATEST EDITION.
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5. CONTRACTOR SHALL DESIGN AND INSTALL ALL DRAINAGE SYSTEMS FOR THIS PROJECT.
6. LIGHTING LOCATIONS ARE CONCEPTUAL. CONTRACTOR TO PROVIDE FINAL LIGHTING COMPUTATIONS AND LOCATIONS.
7. SEE SHEET E-502 FOR TYPICAL PLAN VIEW AT RVSS TOWER .

XX KEYNOTES

1. PROPOSED NEW TYPE P-3 BOLLARD FENCE.
2. PROPOSED TYPE FC-2 AGGREGATE ALL-WEATHER ROAD.
3. CLEAR VEGETATION AND GRADE WITHIN ENFORCEMENT ZONE.
4. PROPOSED LIGHT POLE, PULLBOX, AND LIGHTING - SEE ELEC. FOR LOCATIONS. (TYP.)
5. PROPOSED POWER AND LIGHTING DISTRIBUTION CABLE AND CONDUIT/DUCTBANK.
6. PROPOSED FENCE GROUNDING LOCATIONS.
7. PROPOSED COMMUNICATION CONDUIT/ DUCTBANK. (CABLE FUTURE BY OTHERS)
8. GATE ELECTRICAL DISTRIBUTION EQUIPMENT.
9. GATE GROUNDING LOCATIONS.
10. PROPOSED MOTORIZED VEHICLE SLIDE GATE.
11. PROPOSED RVSS SITE.
12. CONCEPTUAL ELECTRICAL UTILITY CONNECTION POINT.
13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

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DRAWN BY: X
CHECKED BY: X
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SIZE: ANSI D
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FILE NUMBER:

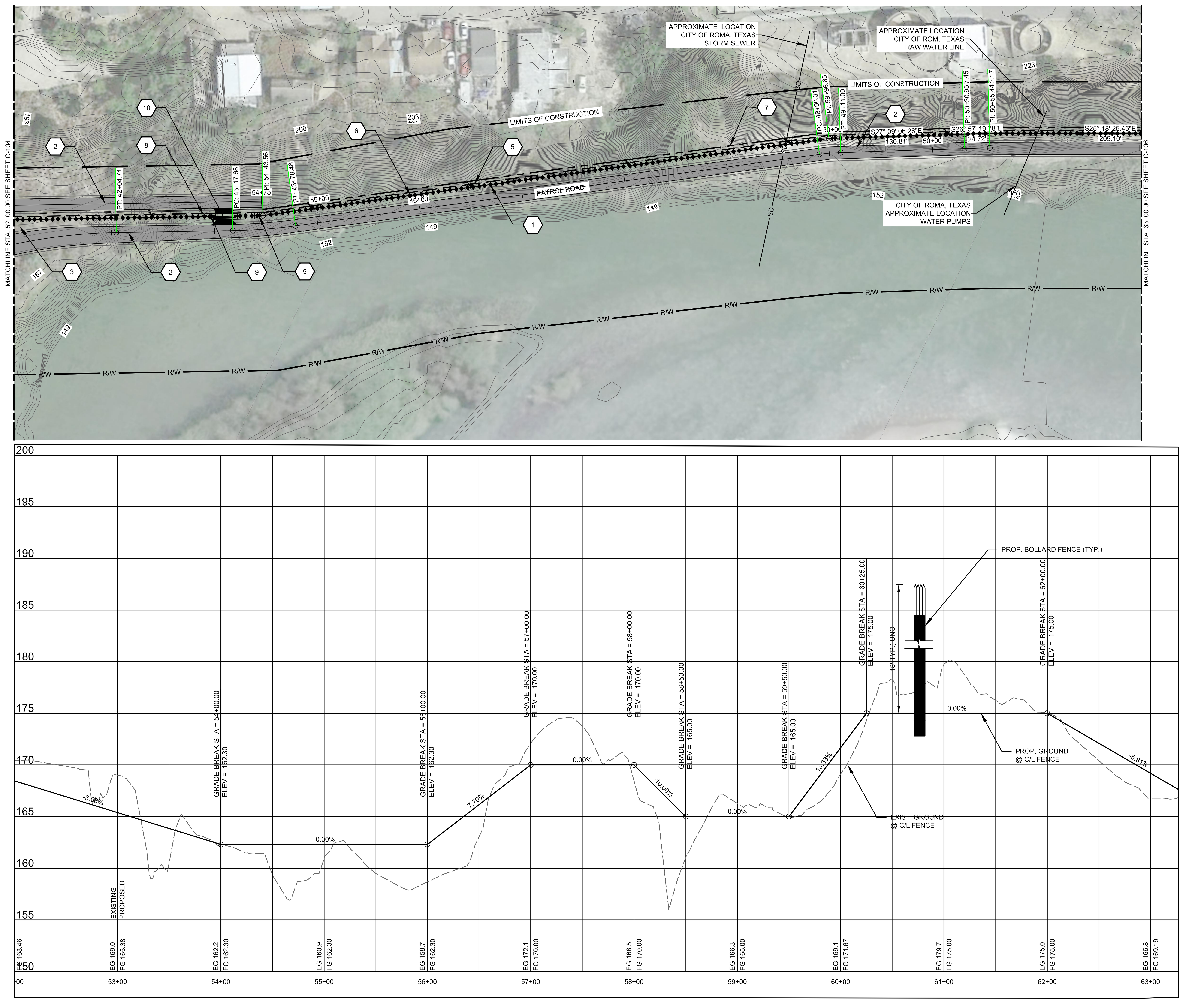
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 41+00.00 - 52+00.00

SHEET ID
ROMA
C-104



A1 PLAN AND PROFILE

SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

1" = 50' - 0"

1" = 5' - 0"

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13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

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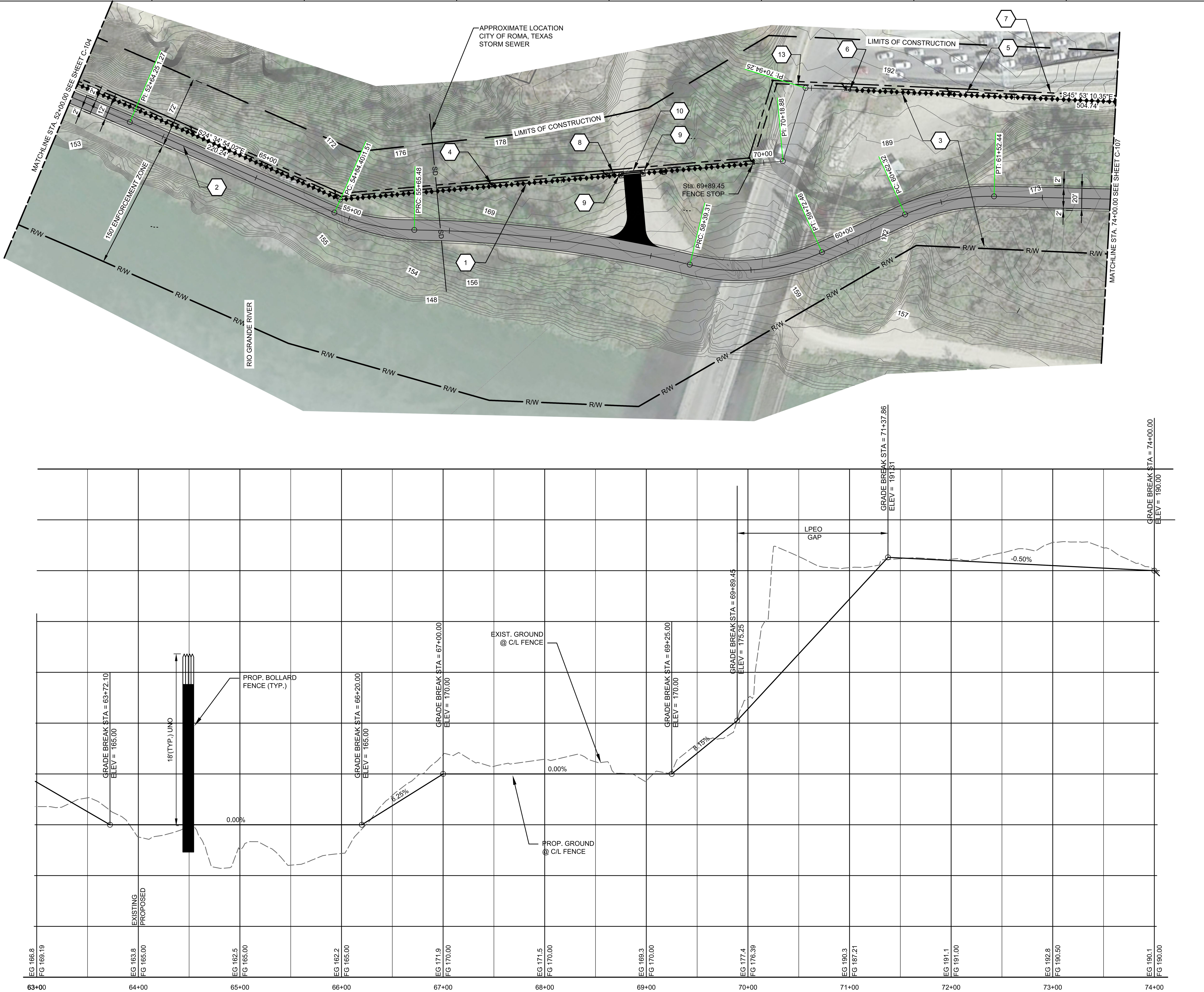
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 52+00.00 - 63+00.00

SHEET ID
ROMA
C-105



A1 PLAN AND PROFILE
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13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

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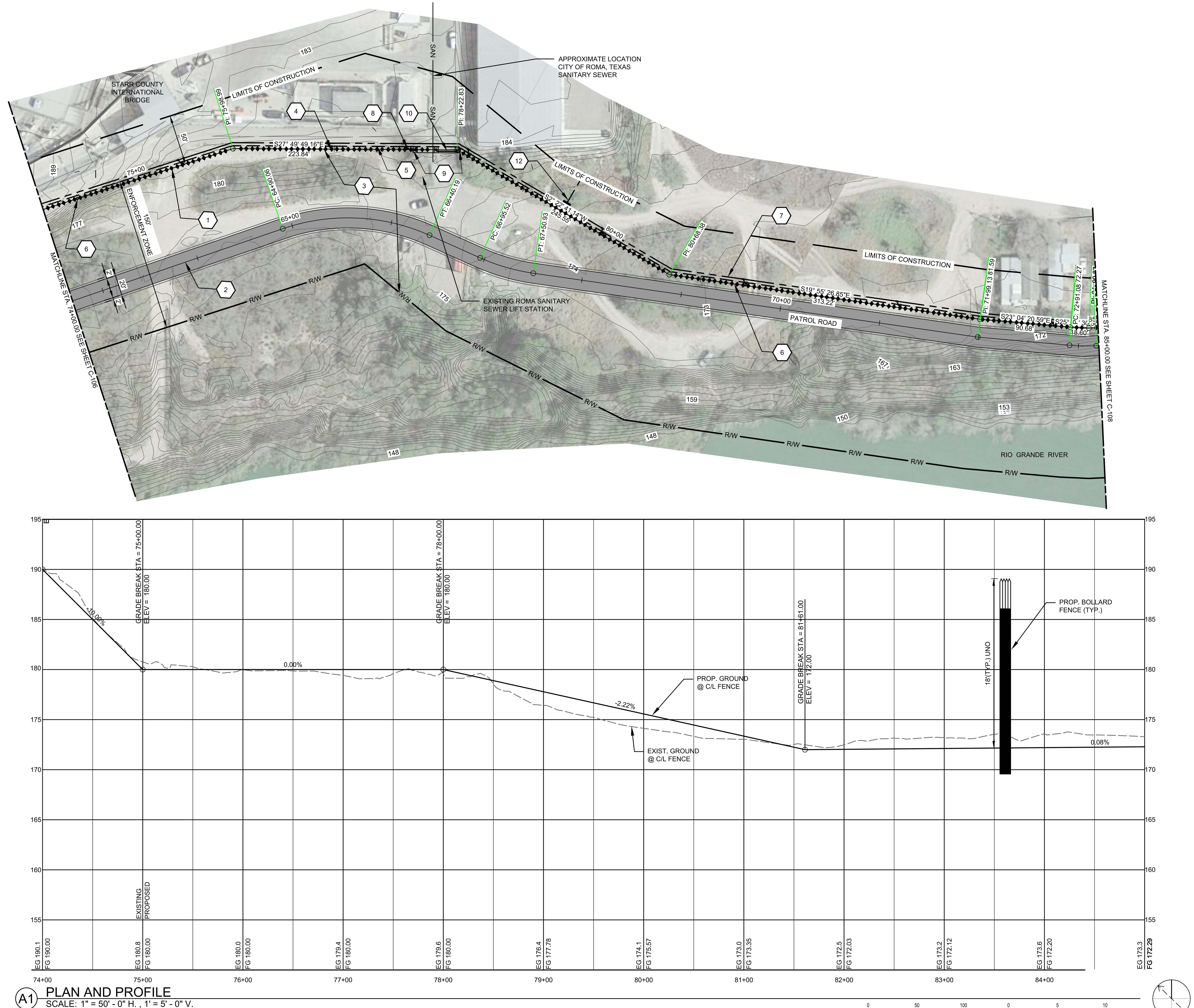
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 63+00.00 - 74+00.00

SHEET ID
ROMA
C-106



A1 PLAN AND PROFILE
SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

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7. SEE SHEET E-502 FOR TYPICAL PLAN VIEW AT RVSS TOWER .

XX KEYNOTES

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13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

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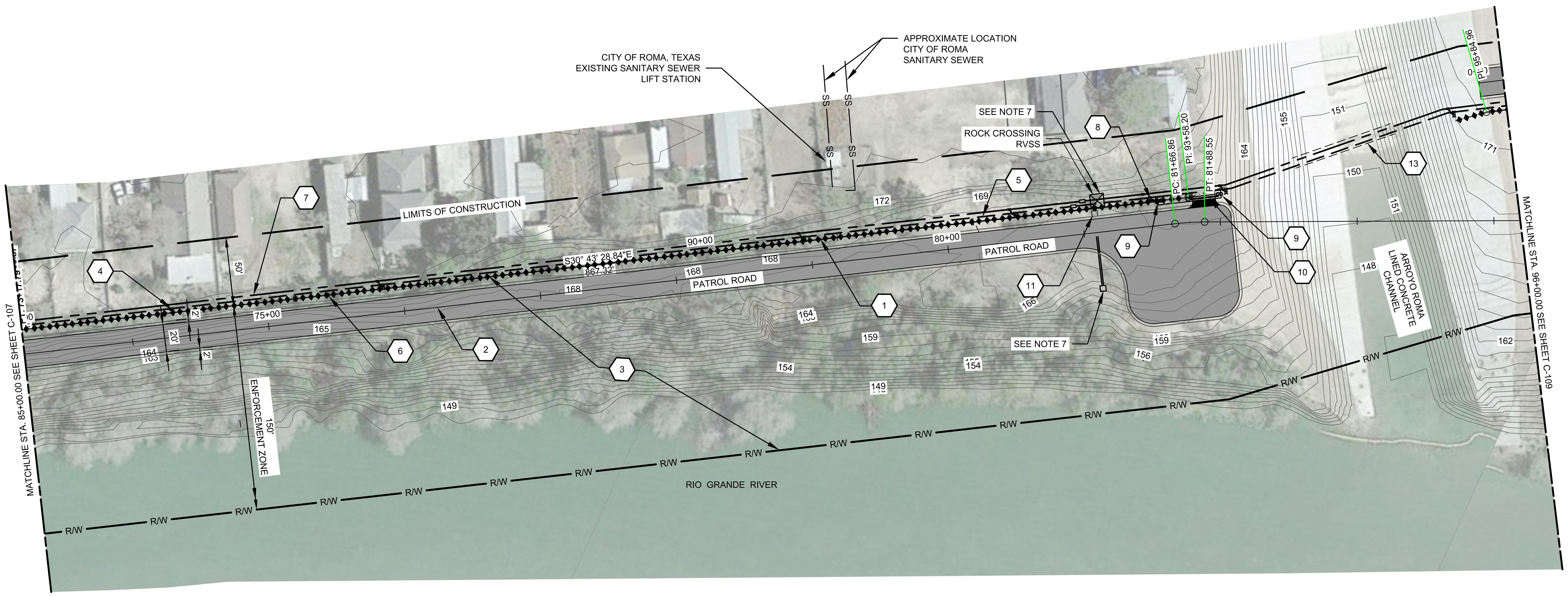
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

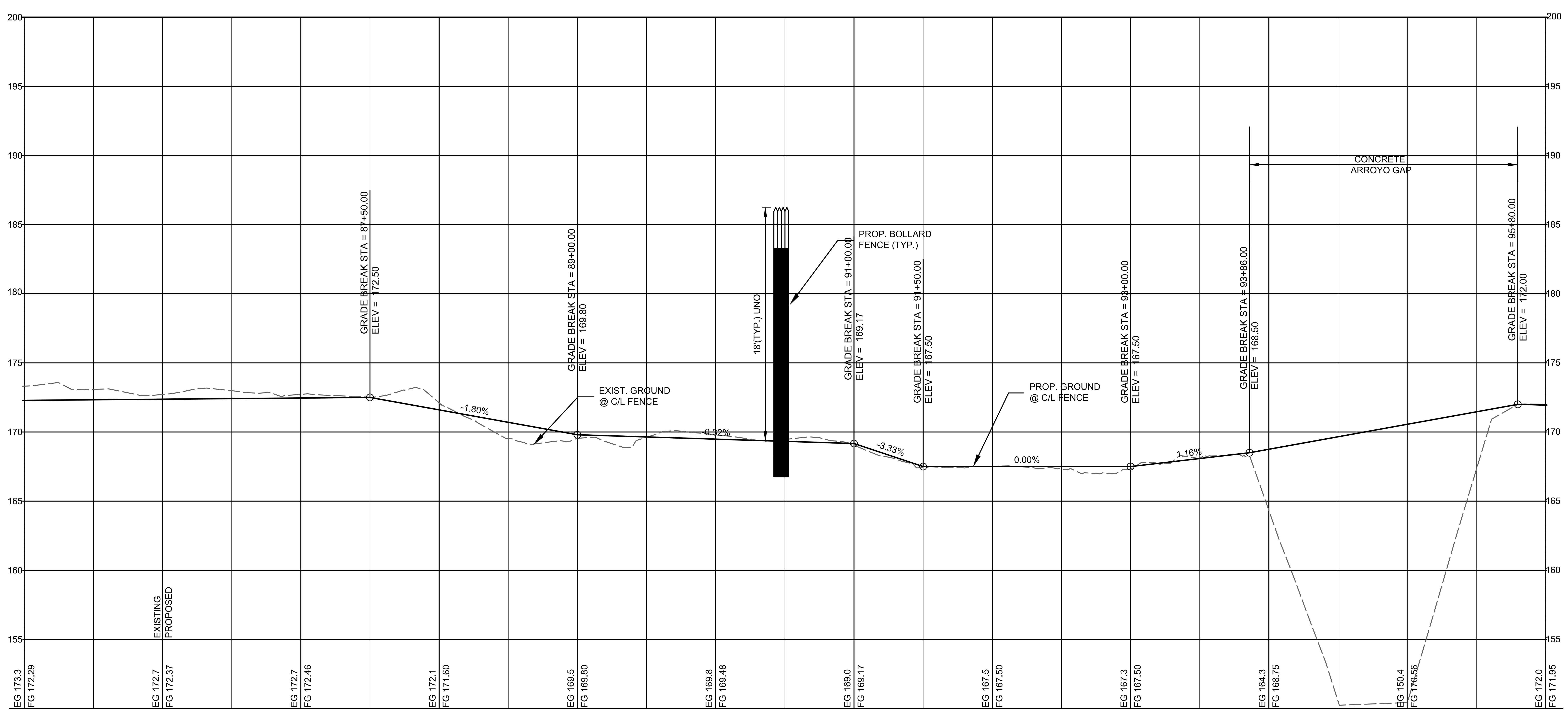
ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 74+00.00 - 85+00.00

SHEET ID
ROMA
C-107





A1 PLAN AND PROFILE
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US Army Corps of Engineers ®

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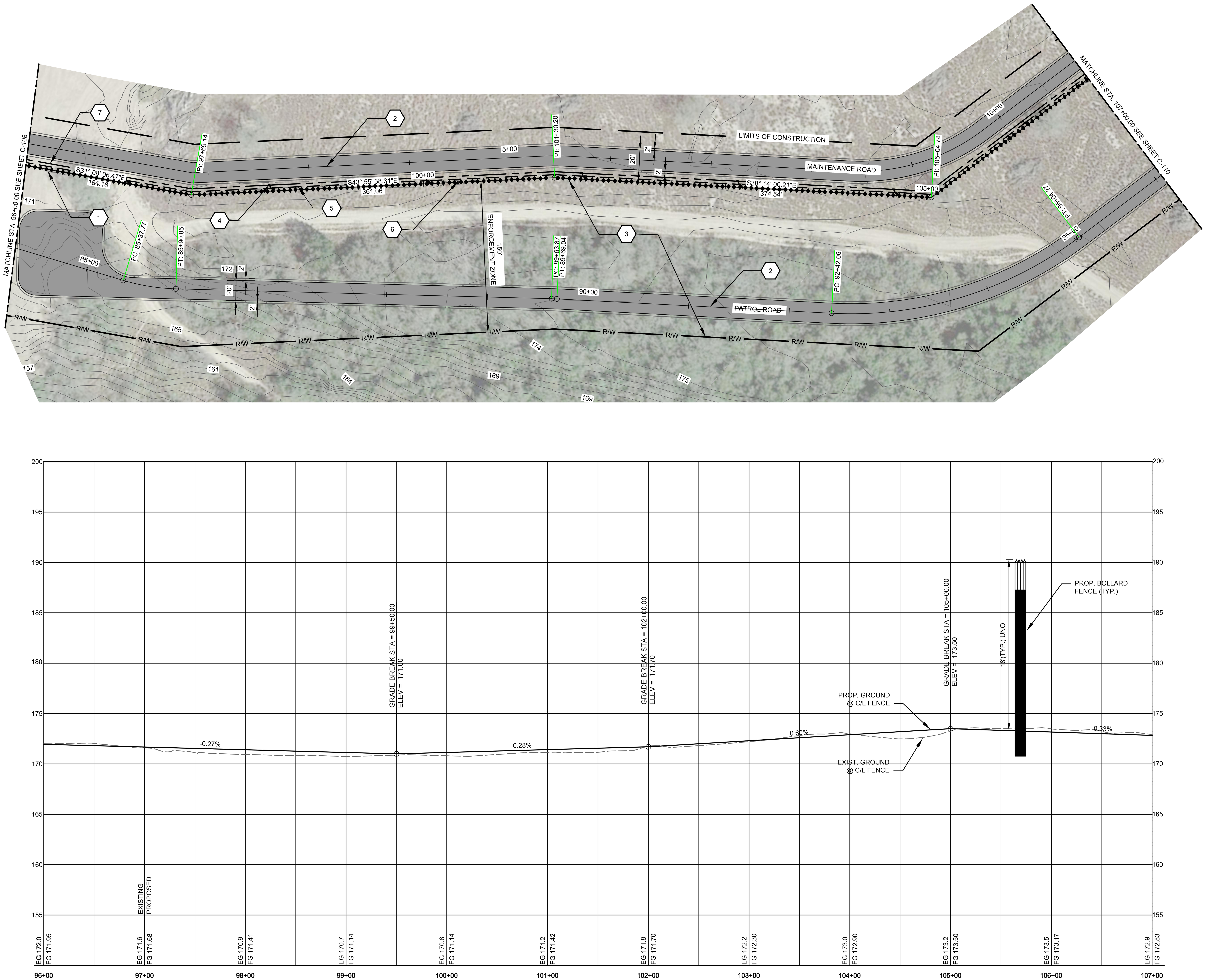
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 85+00.00 - 96+00.00

SHEET ID
ROMA
C-108



A1 PLAN AND PROFILE
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US Army Corps of Engineers ®

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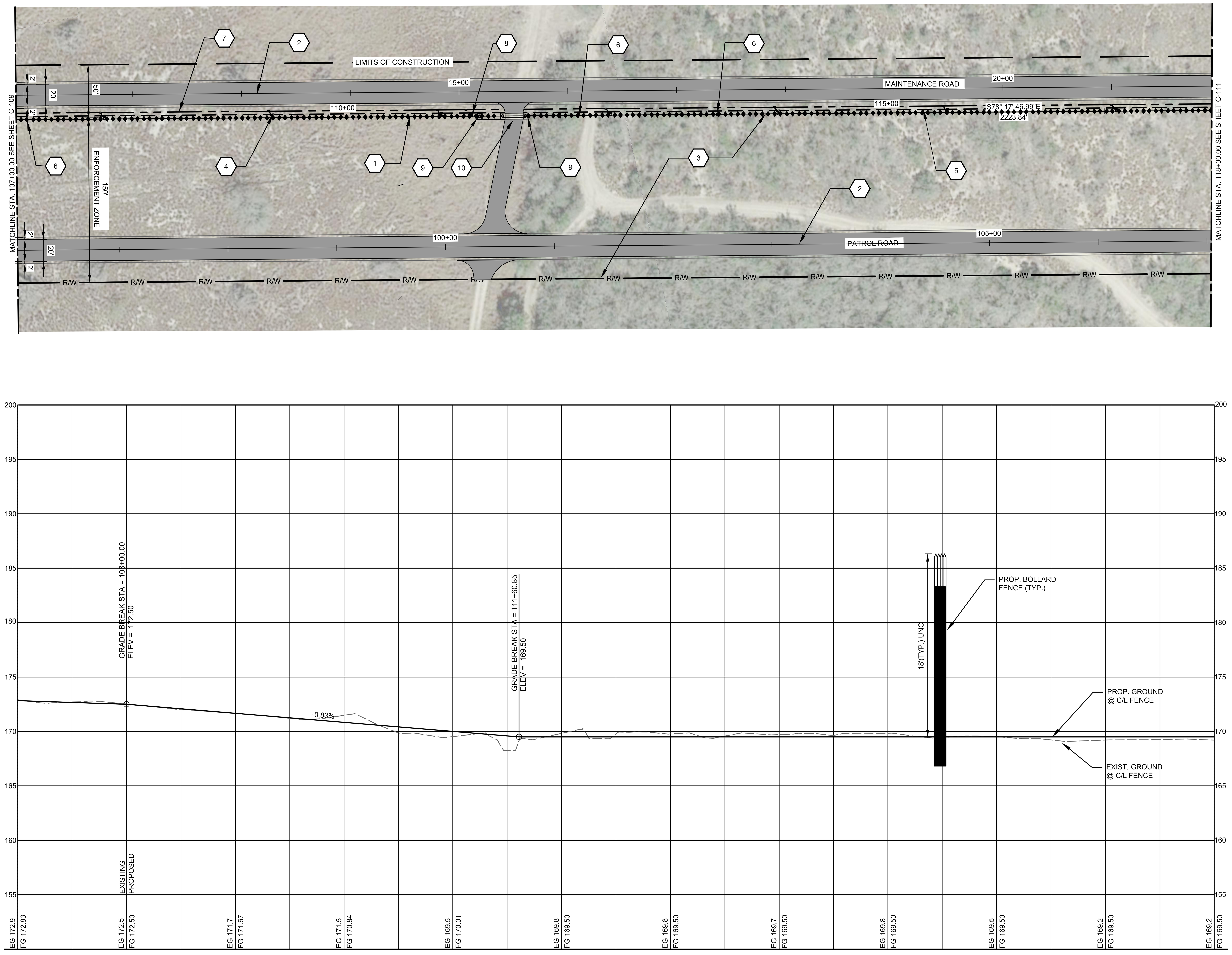
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 96+00.00 - 107+00.00

SHEET ID
ROMA
C-109



A1 PLAN AND PROFILE
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1' = 50' - 0"   1' = 5' - 0"

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US Army Corps of Engineers ®

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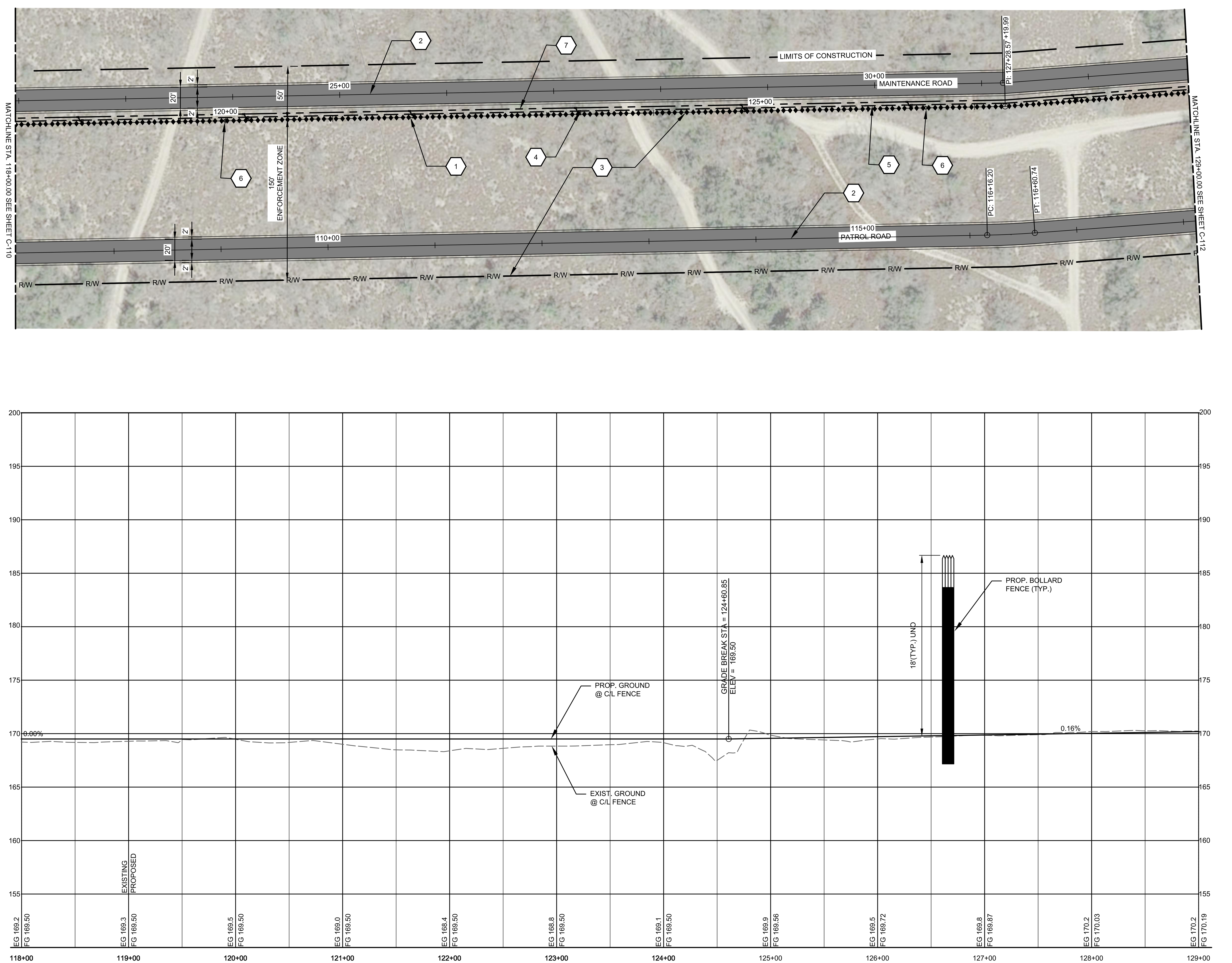
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 107+00.00 - 118+00.00

SHEET ID
ROMA
C-110



A1 PLAN AND PROFILE

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US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

DESIGNED BY: X | DRAWN BY: X | CHECKED BY: X | SUBMITTED BY: X | SIZE: ANSI D

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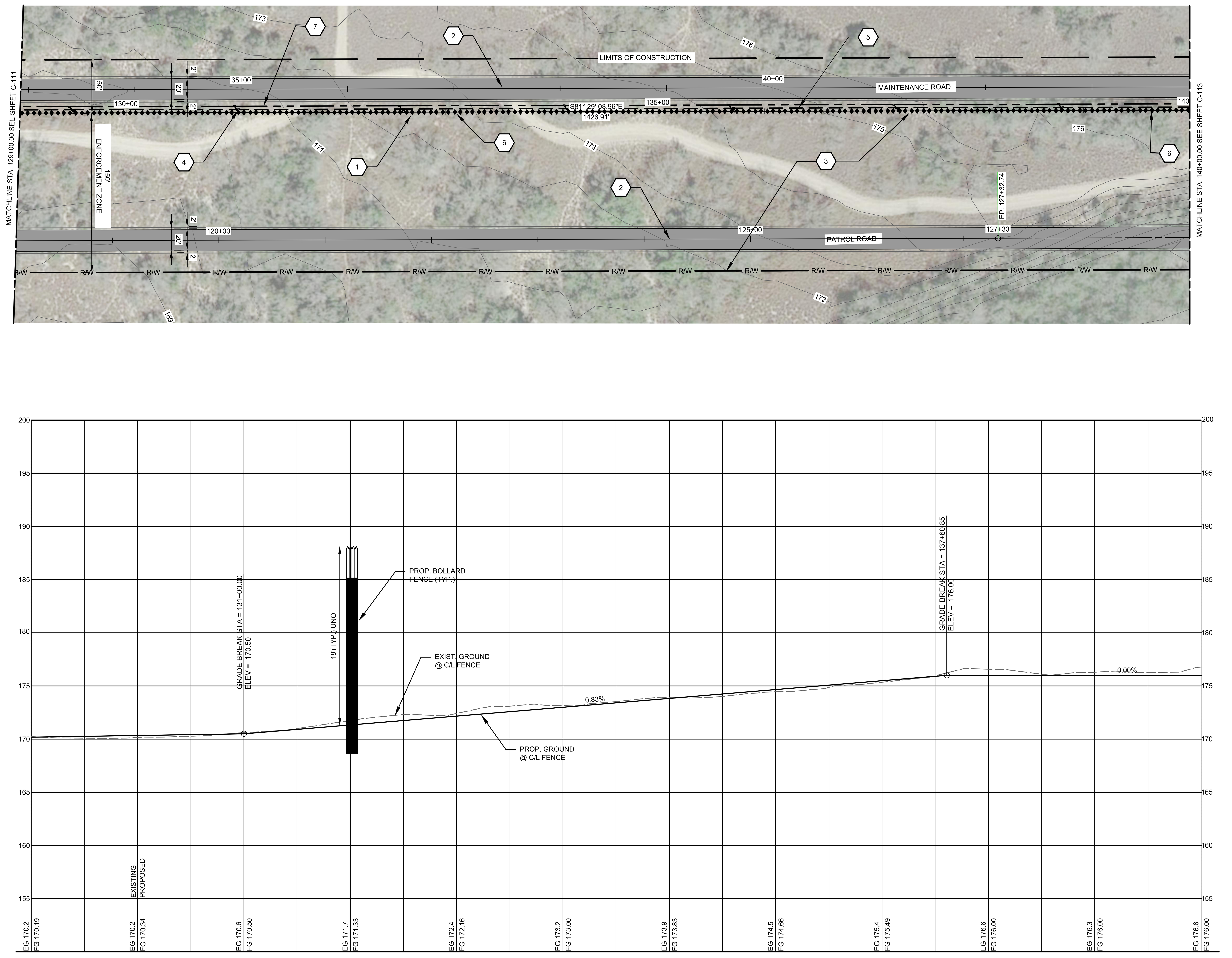
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 118+00.00 - 129+00.00

SHEET ID
ROMA
C-111



A1 PLAN AND PROFILE
SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

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XX KEYNOTES

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12. CONCEPTUAL ELECTRICAL UTILITY CONNECTION POINT.
13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

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DRAWN BY: X
CHECKED BY: X
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SIZE: ANSI D
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SOLICITATION NO:
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US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 129+00.00 - 140+00.00

SHEET ID
ROMA
C-112

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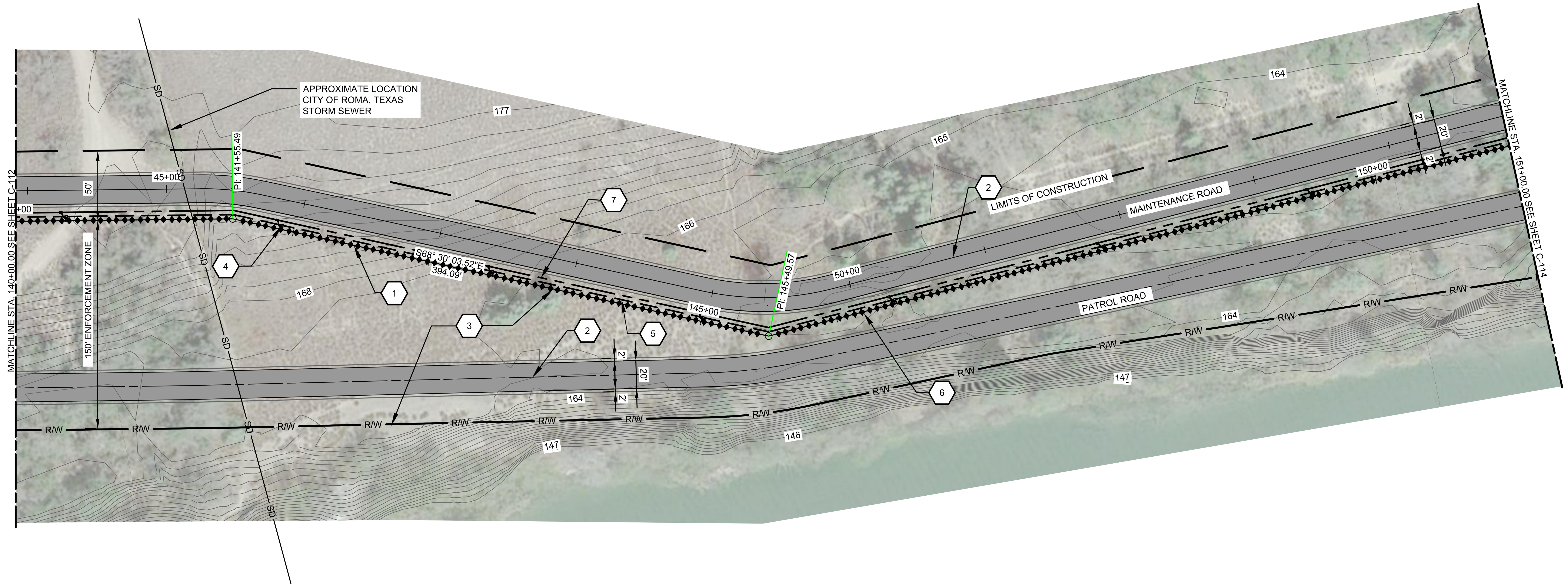

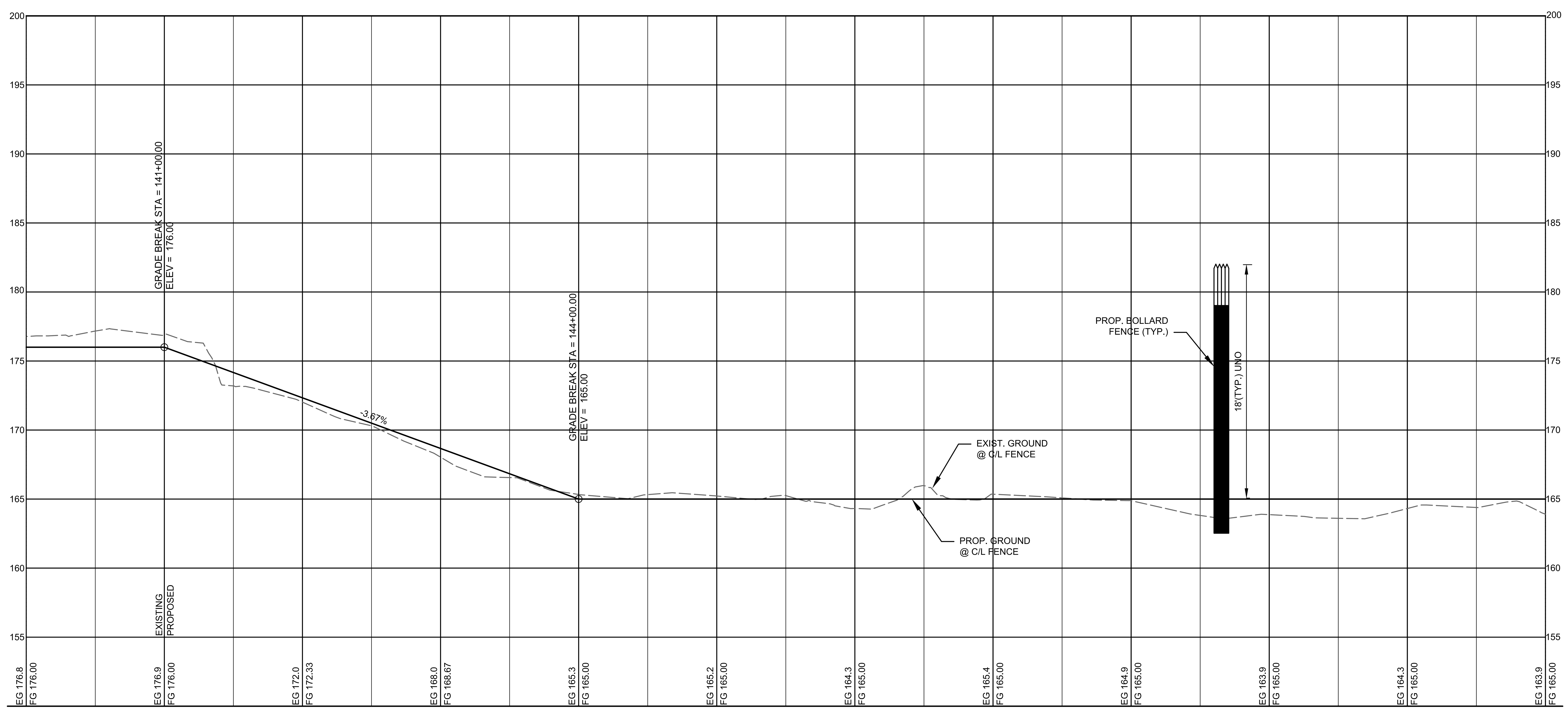

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US Army Corps of Engineers ®

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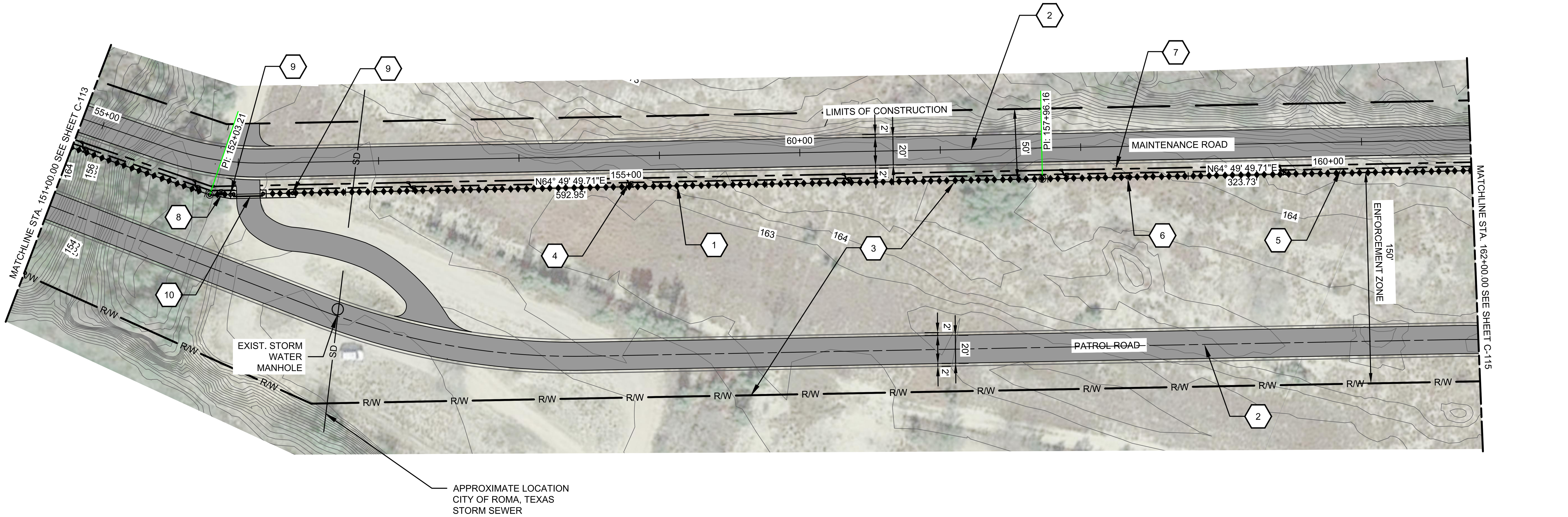
GALVESTON, TX 77553-1229

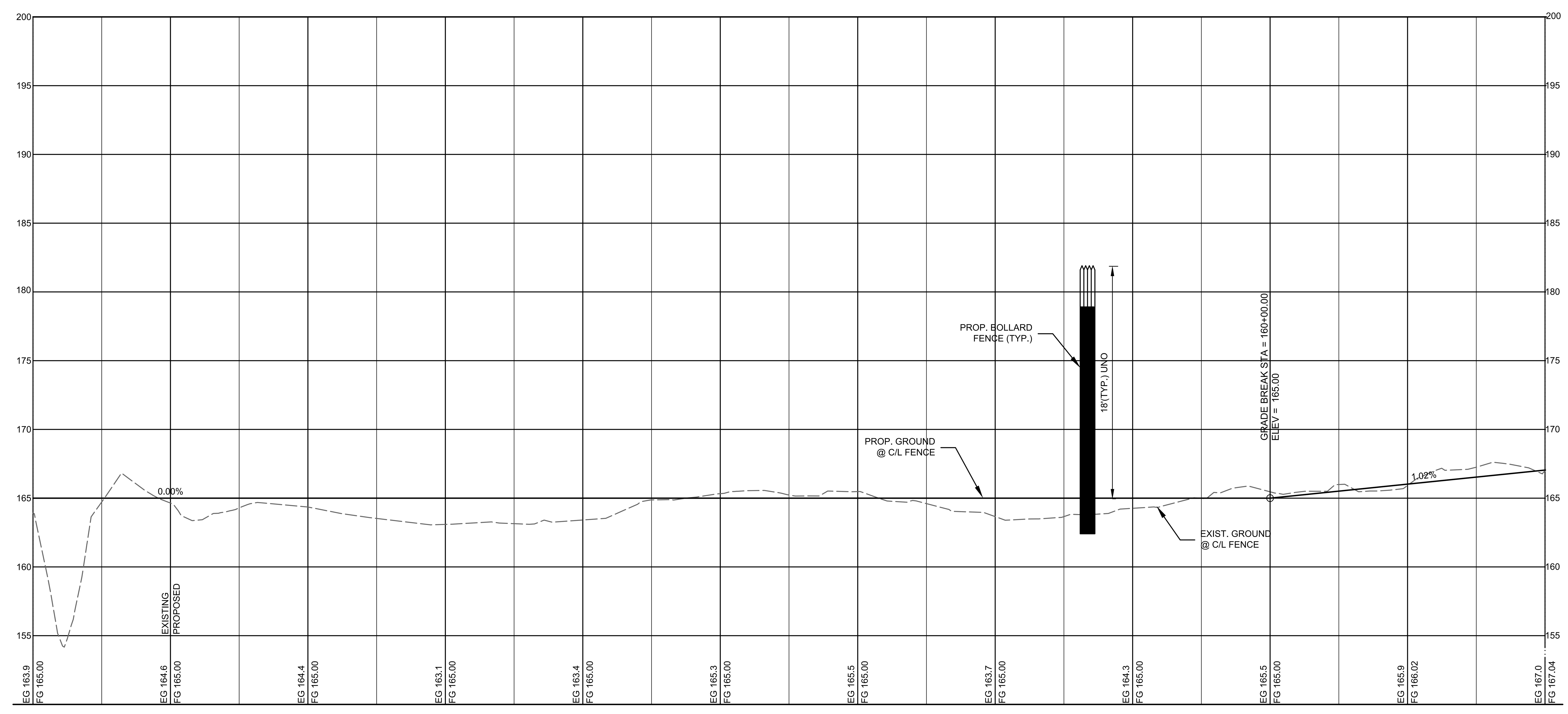
ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 140+00.00 - 151+00.00

SHEET ID
ROMA
C-113





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US Army Corps of Engineers ®

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US ARMY CORPS OF ENGINEERS
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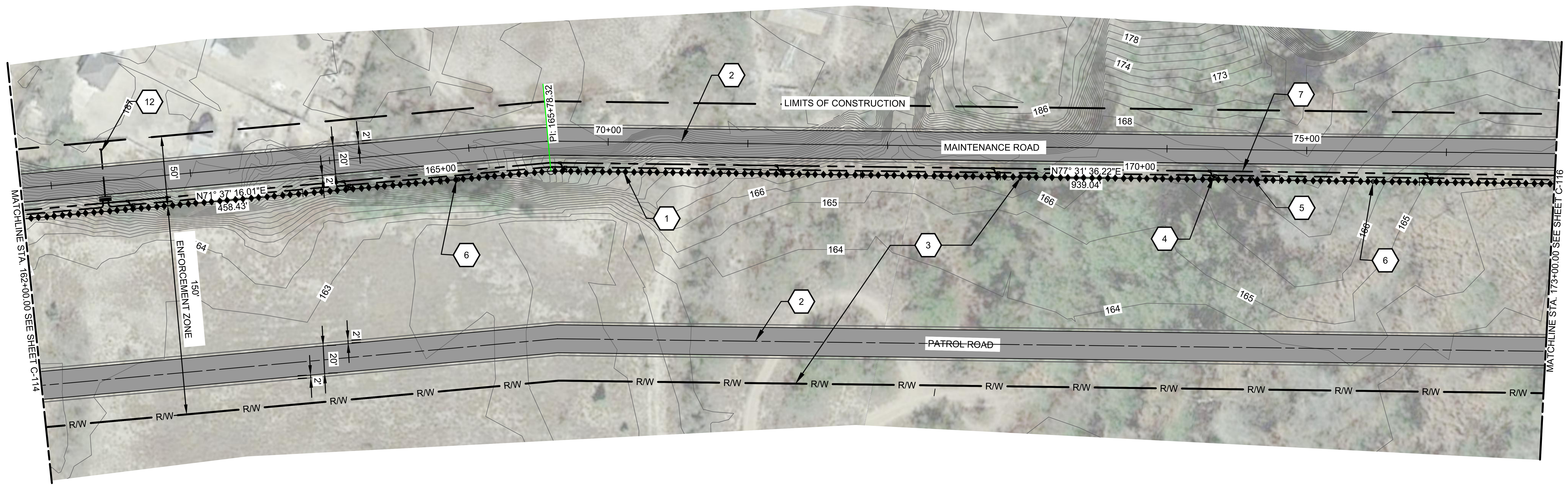
GALVESTON, TX 77553-1229

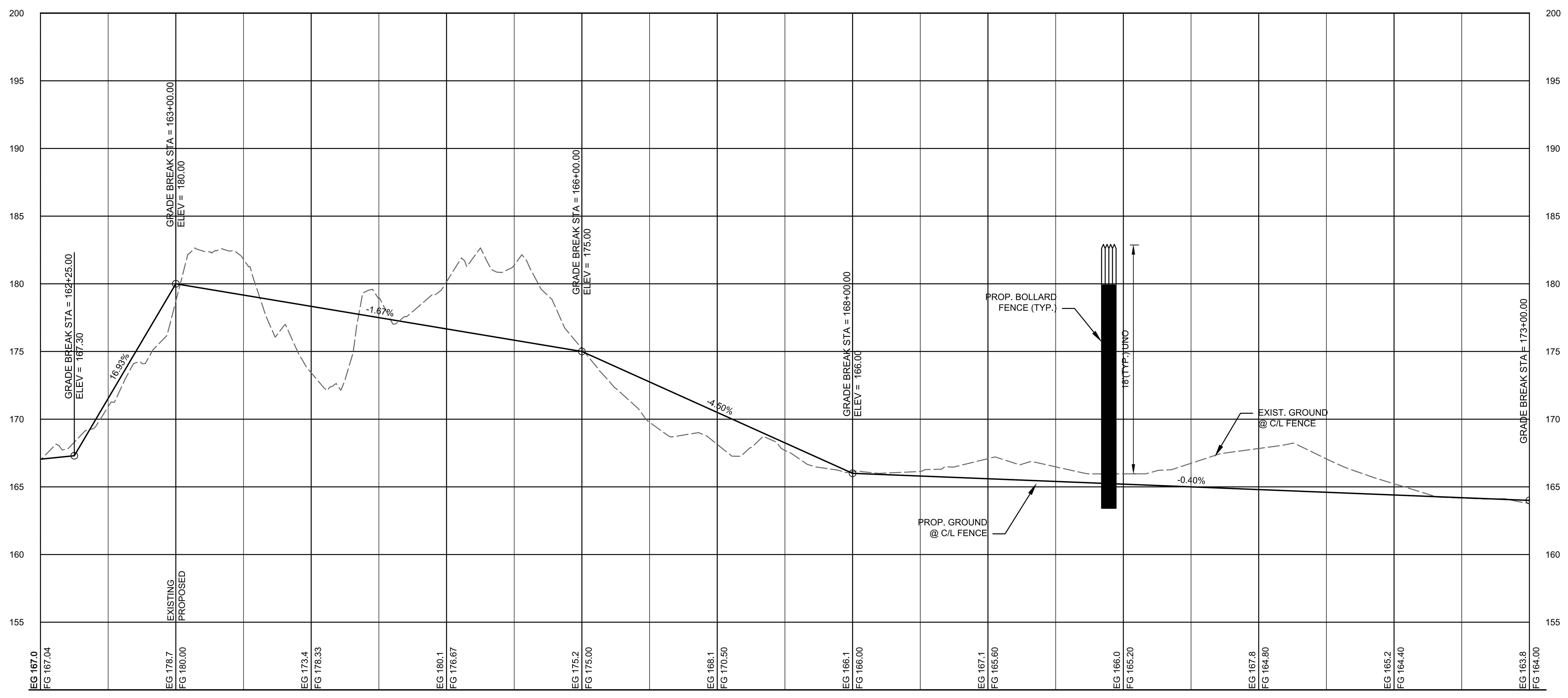
ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 151+00.00 - 162+00.00

SHEET ID
ROMA
C-114





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US Army Corps of Engineers ®

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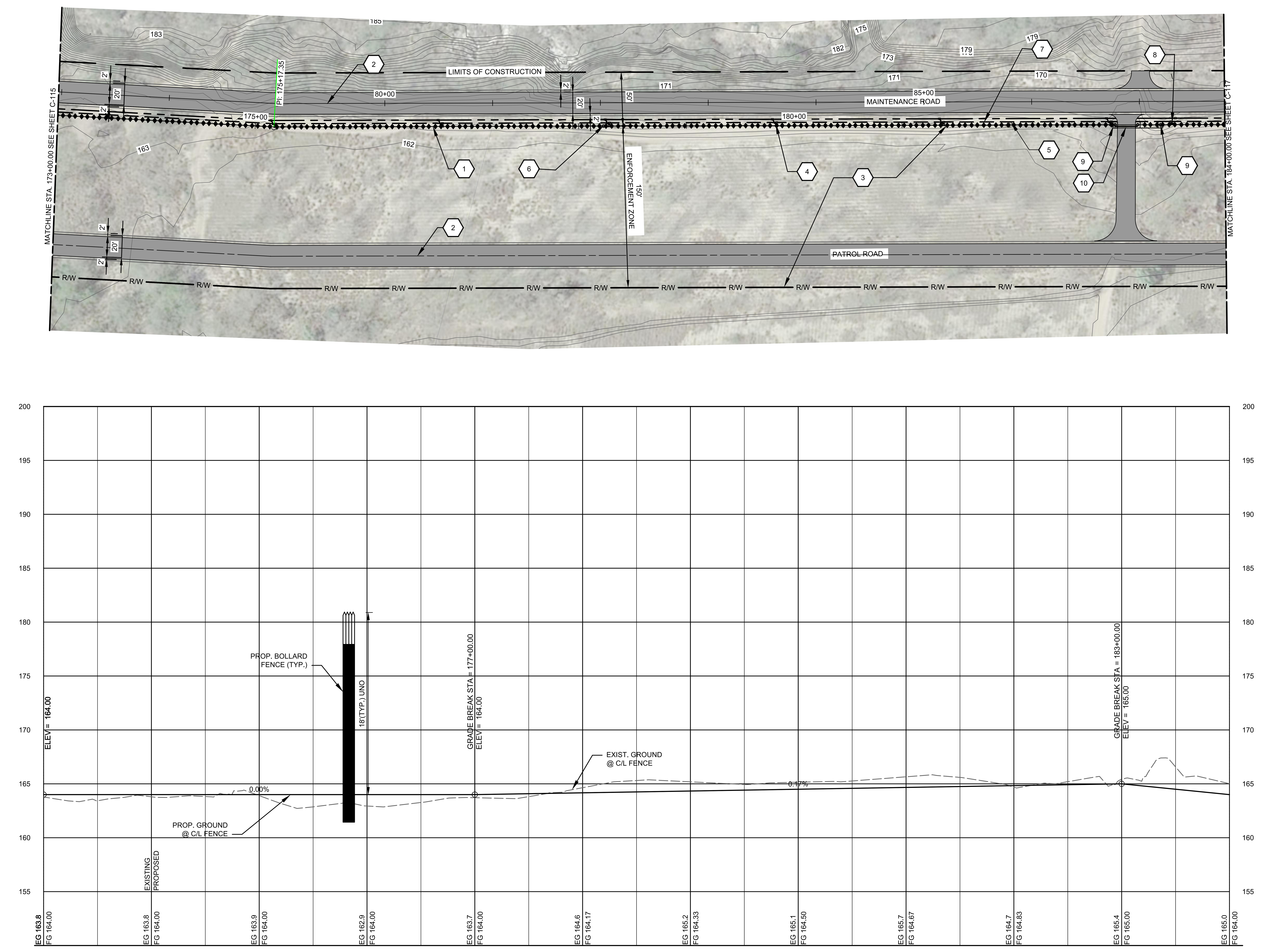
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 162+00.00 - 173+00.00

SHEET ID
ROMA
C-115



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US Army Corps of Engineers ®

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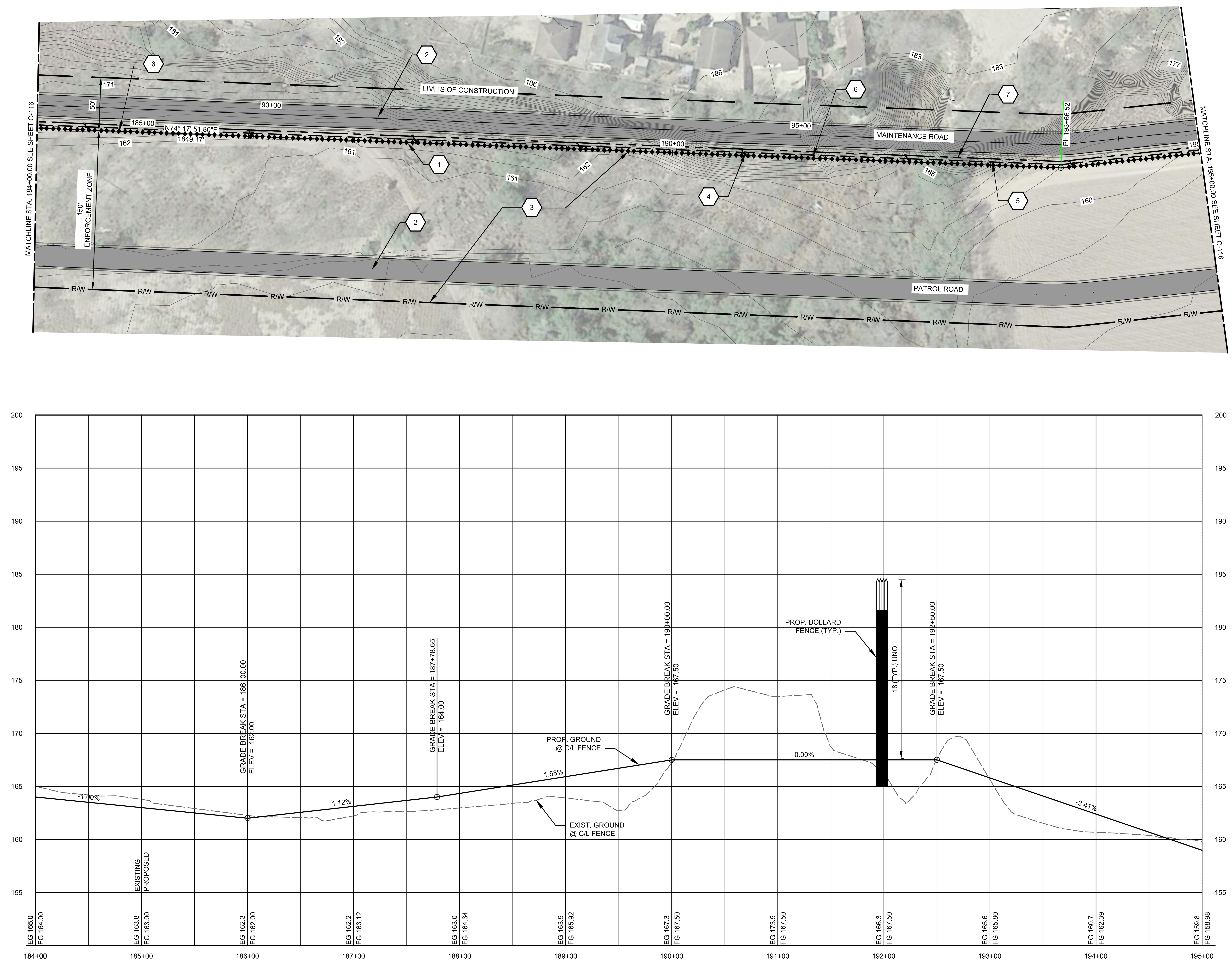
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 173+00.00 - 184+00.00

SHEET ID
ROMA
C-116



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US Army Corps of Engineers ®

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US ARMY CORPS OF ENGINEERS
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ETEGRA
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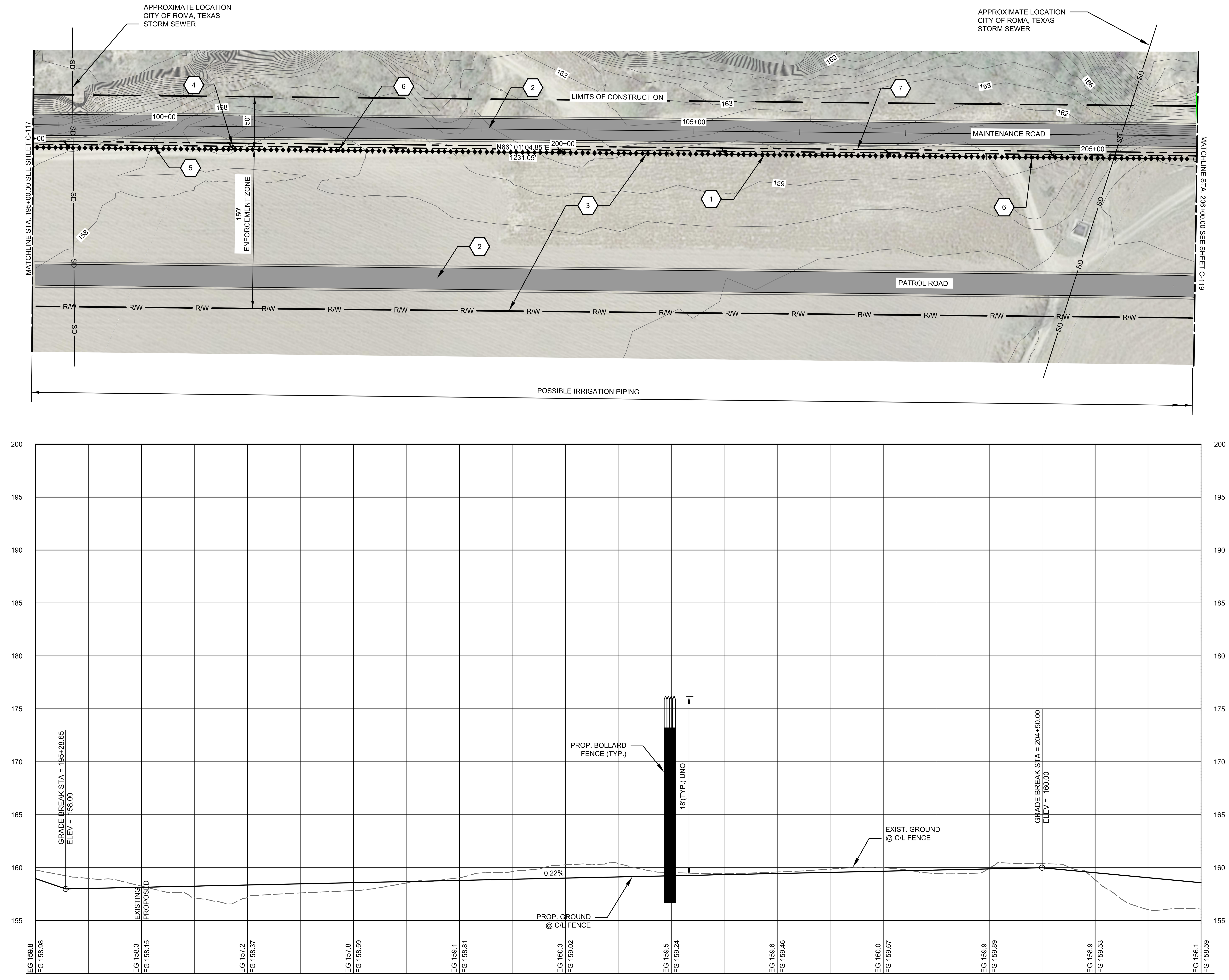
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 184+00.00 - 195+00.00

SHEET ID
ROMA
C-117



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US Army Corps of Engineers ®

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US ARMY CORPS OF ENGINEERS
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ETEGRA
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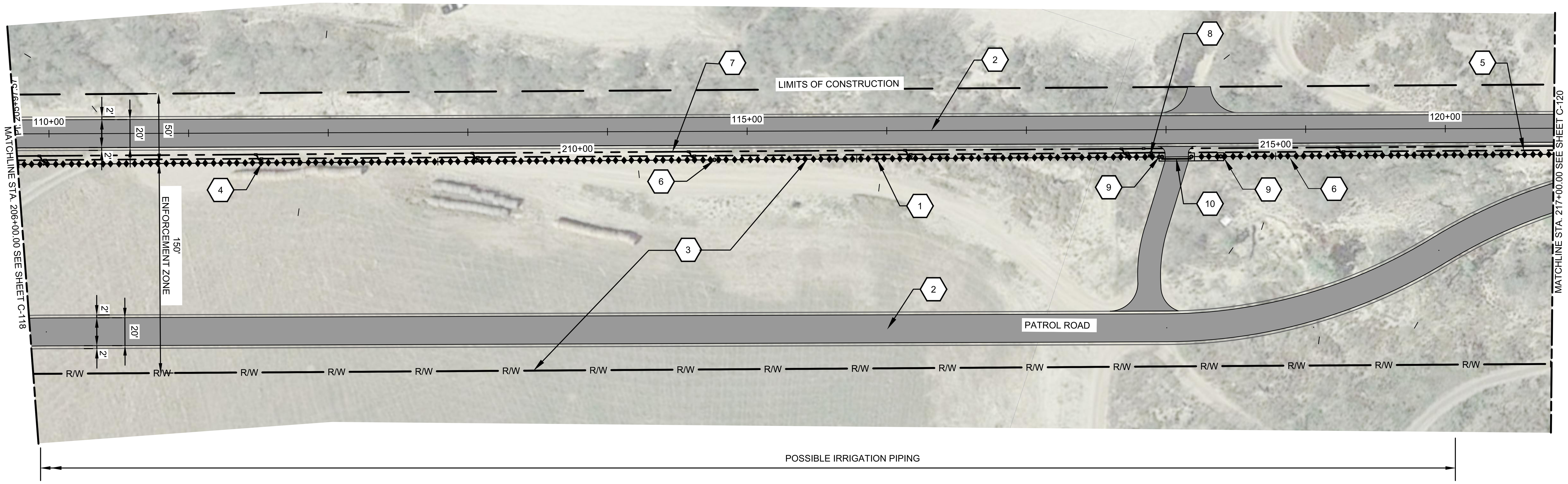
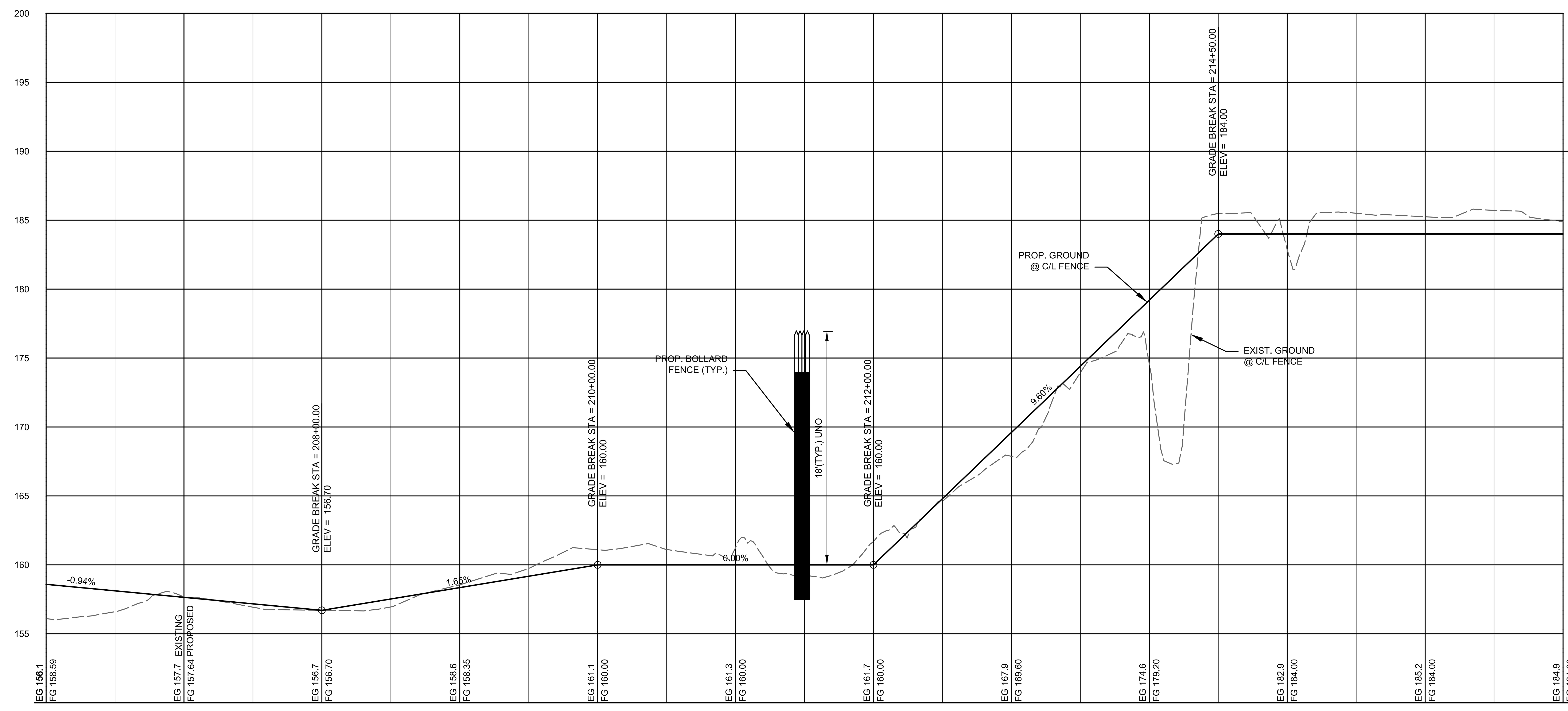
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 195+00.00 - 206+00.00

SHEET ID
ROMA
C-118





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8. GATE ELECTRICAL DISTRIBUTION EQUIPMENT.
9. GATE GROUNDING LOCATIONS.
10. PROPOSED MOTORIZED VEHICLE SLIDE GATE.
11. PROPOSED RVSS SITE.
12. CONCEPTUAL ELECTRICAL UTILITY CONNECTION POINT.
13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

DESIGNED BY: X
DRAWN BY: X
CHECKED BY: X
SUBMITTED BY: X
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ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

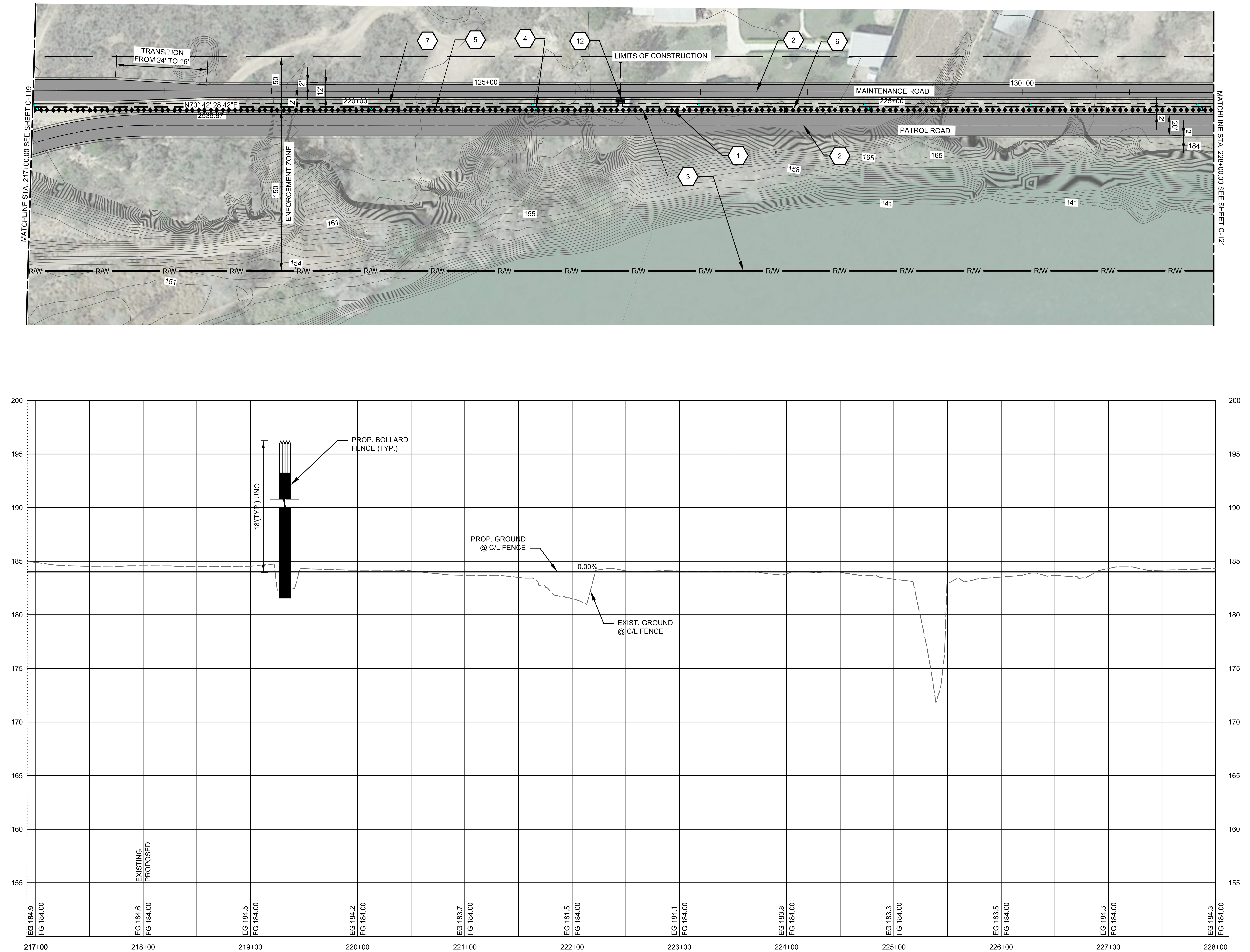
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 206+00.00 - 217+00.00

SHEET ID
ROMA
C-119



A1 PLAN AND PROFILE
SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

GENERAL NOTES

1. THIS SHEET IS AT 35% CONCEPT DESIGN AND NOT TO BE USED FOR CONSTRUCTION.
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3. CONTRACTOR SHALL ENSURE THAT ALL DESIGNS MEET TACTICAL INFRASTRUCTURE STANDARDS, LATEST EDITION.
4. CONTRACTOR SHALL VERIFY LOCATION OF ALL UTILITIES, IRRIGATION CULVERTS AND DRAINAGE STRUCTURES, AND ADJUST/RELOCATE AS REQUIRED TO DE-CONFLICT WITH THE PROPOSED BOLLARD FENCE AND ENFORCEMENT ZONE (I.E.: EX. IRRIGATION VALVES TO BE RELOCATED TO NORTH LEVEE EMBANKMENT).
5. CONTRACTOR SHALL DESIGN AND INSTALL ALL DRAINAGE SYSTEMS FOR THIS PROJECT.
6. LIGHTING LOCATIONS ARE CONCEPTUAL. CONTRACTOR TO PROVIDE FINAL LIGHTING COMPUTATIONS AND LOCATIONS.

XX KEYNOTES

1. PROPOSED NEW TYPE P-3 BOLLARD FENCE.
2. PROPOSED TYPE FC-2 AGGREGATE ALL-WEATHER ROAD.
3. CLEAR VEGETATION AND GRADE WITHIN ENFORCEMENT ZONE.
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US Army Corps of Engineers ®

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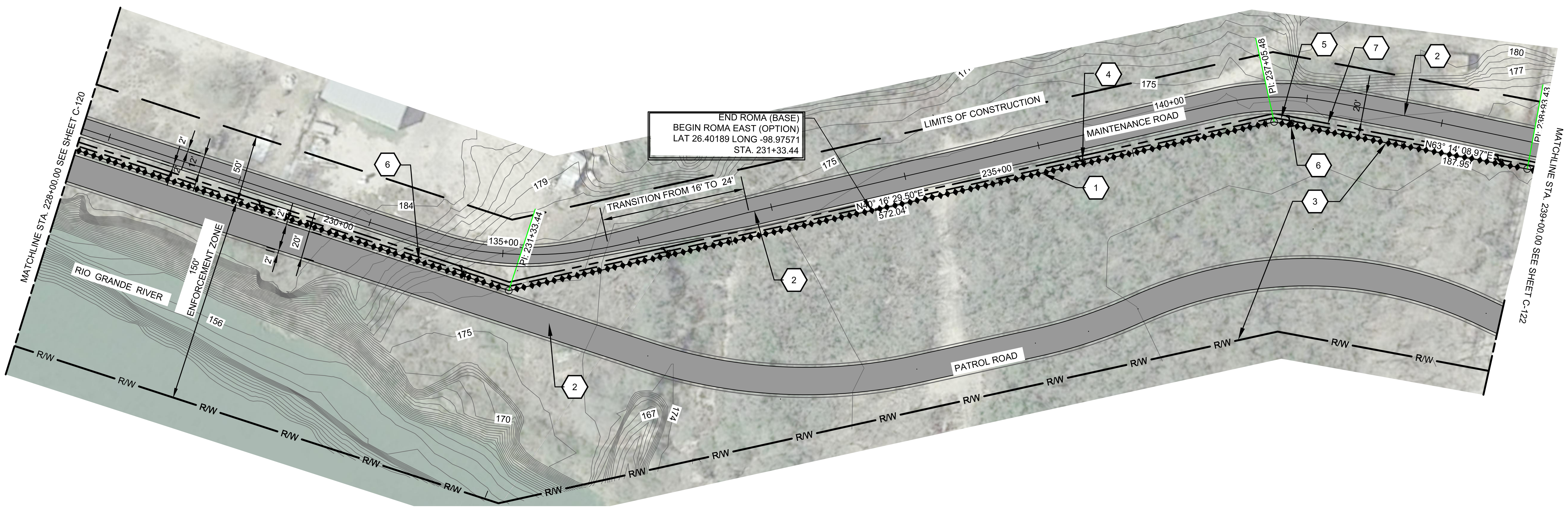
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

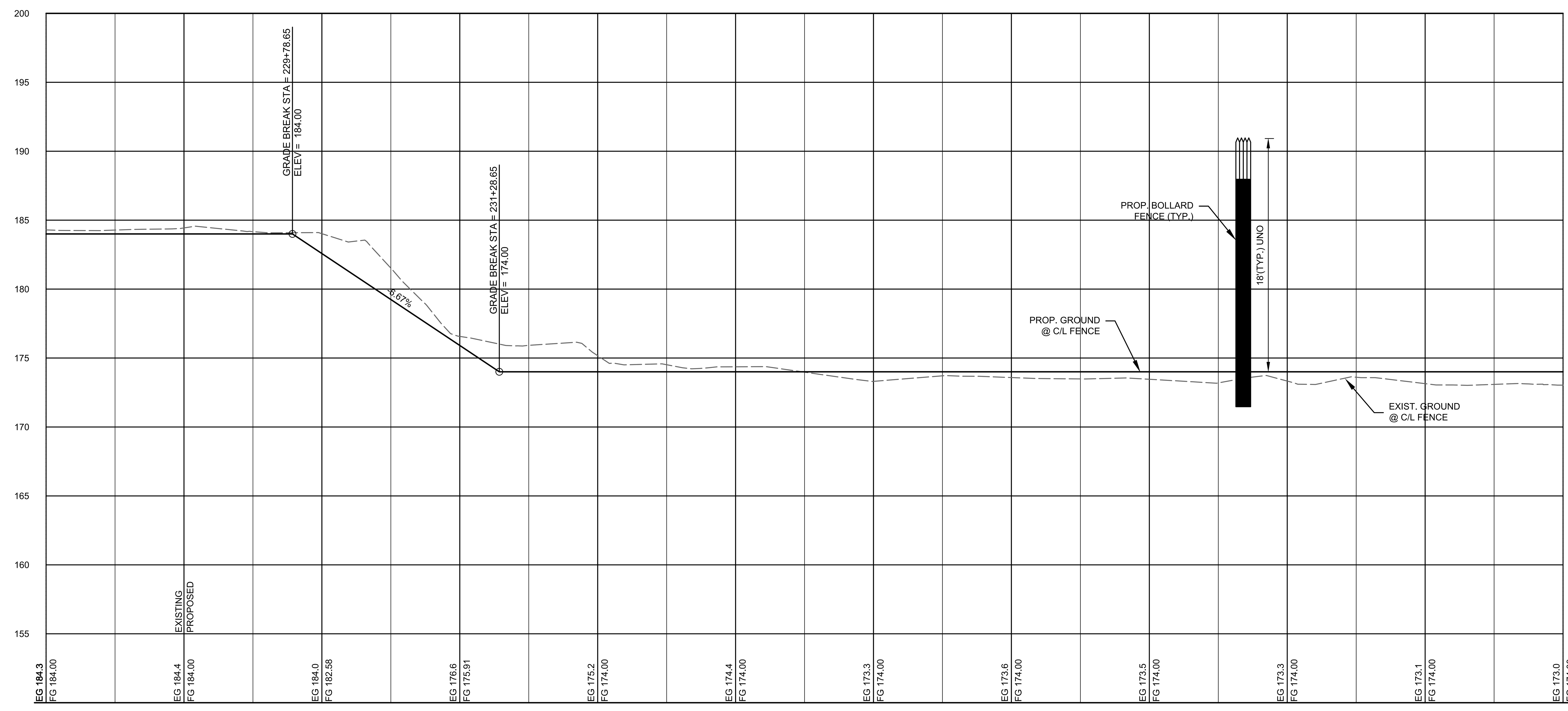
ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 217+00.00 - 228+00.00

SHEET ID
ROMA
C-120





A1 PLAN AND PROFILE
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1" = 50' - 0"
1' = 5' - 0"

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US Army Corps of Engineers ®

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US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
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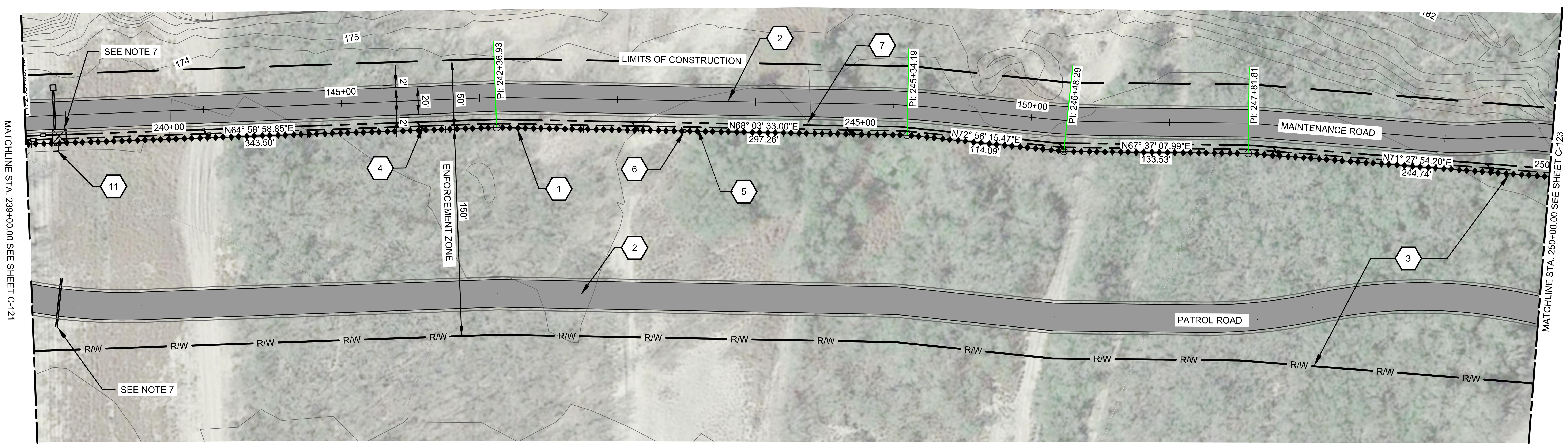
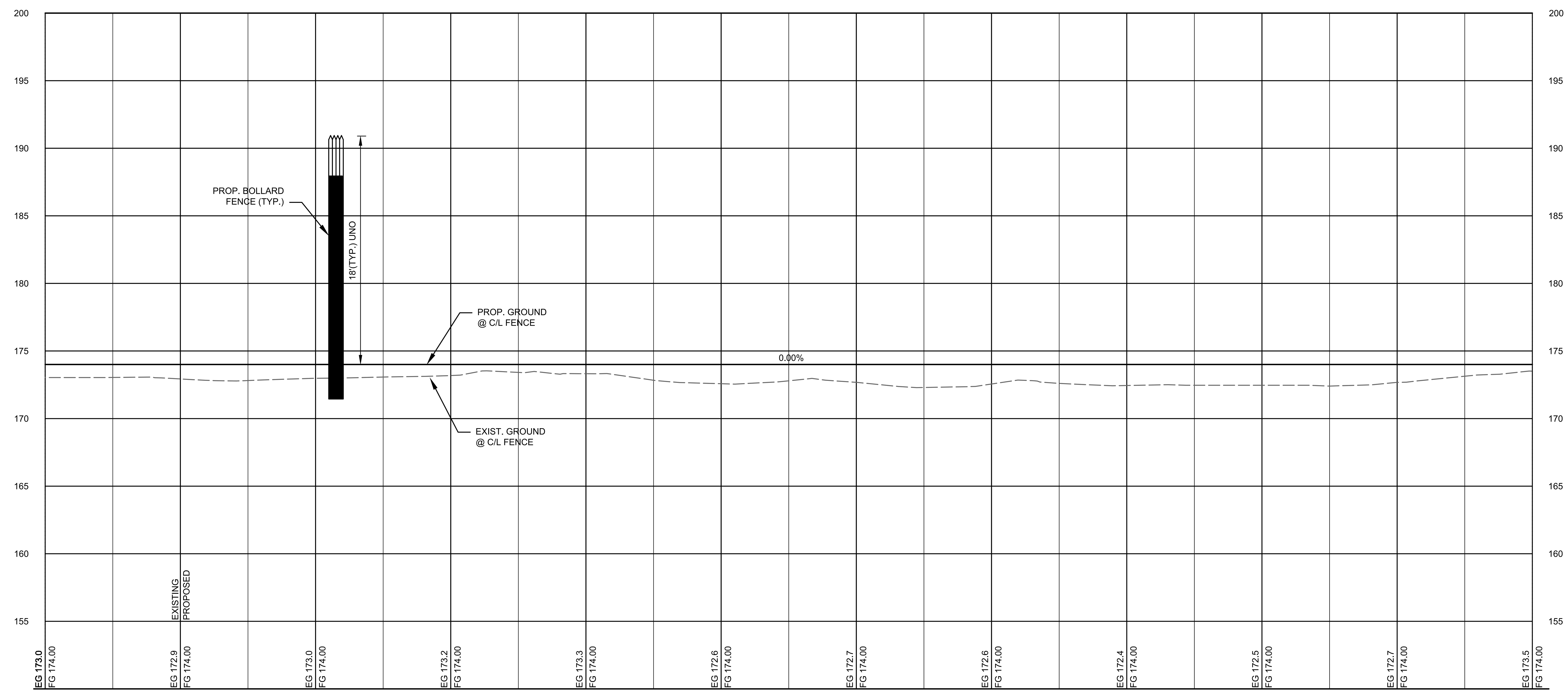
ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 228+00.00 - 239+00.00

SHEET ID
ROMA
C-121





A1 PLAN AND PROFILE
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1" = 50' - 0"
1' = 5' - 0"

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7. SEE SHEET E-502 FOR TYPICAL PLAN VIEW AT RVSS TOWER .

XX KEYNOTES

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US Army Corps of Engineers ®

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US ARMY CORPS OF ENGINEERS
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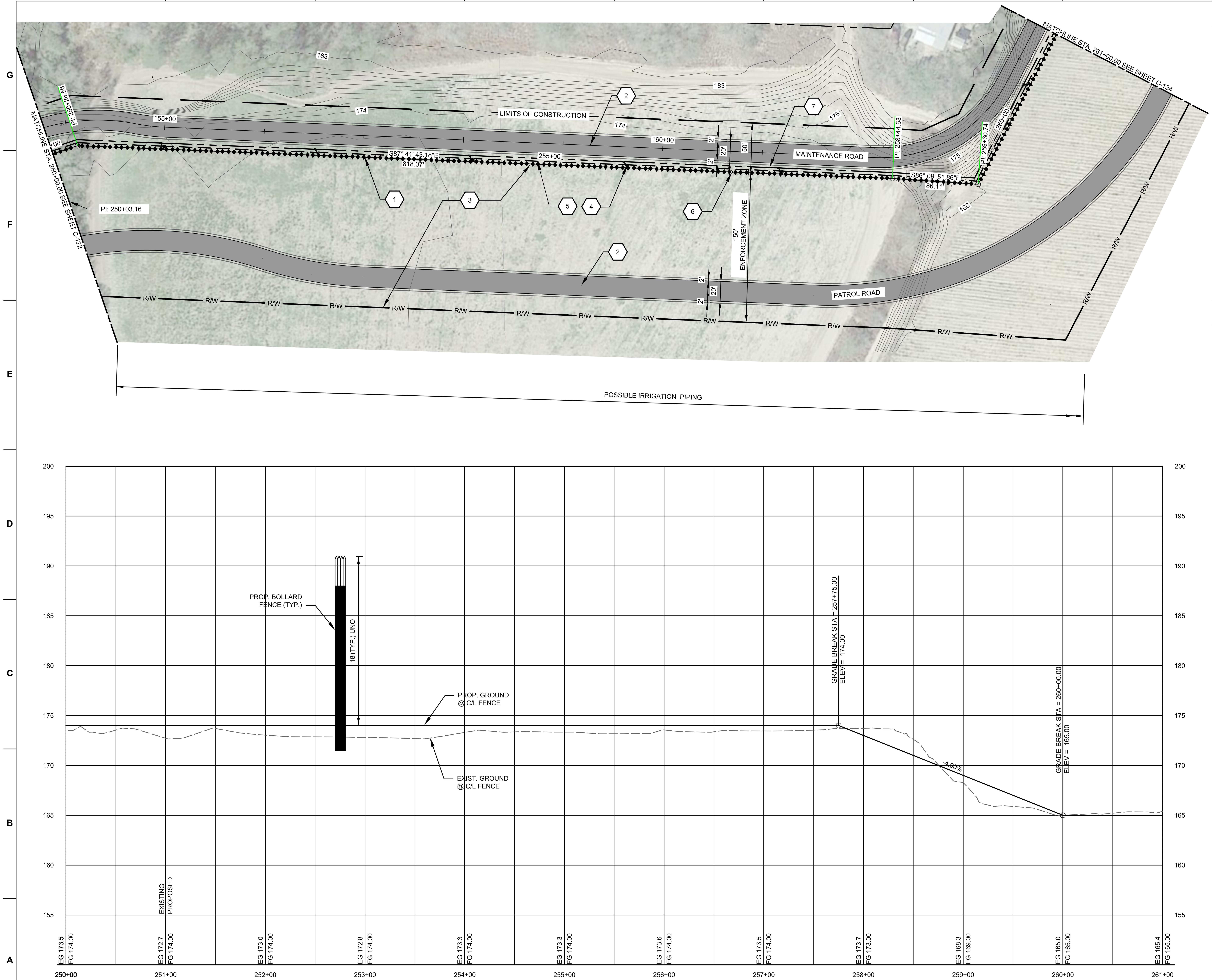
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 239+00.00 - 250+00.00

SHEET ID
ROMA
C-122



A1 PLAN AND PROFILE
SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

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US Army Corps of Engineers ®

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CONTRACT NO.:
FILE NUMBER:

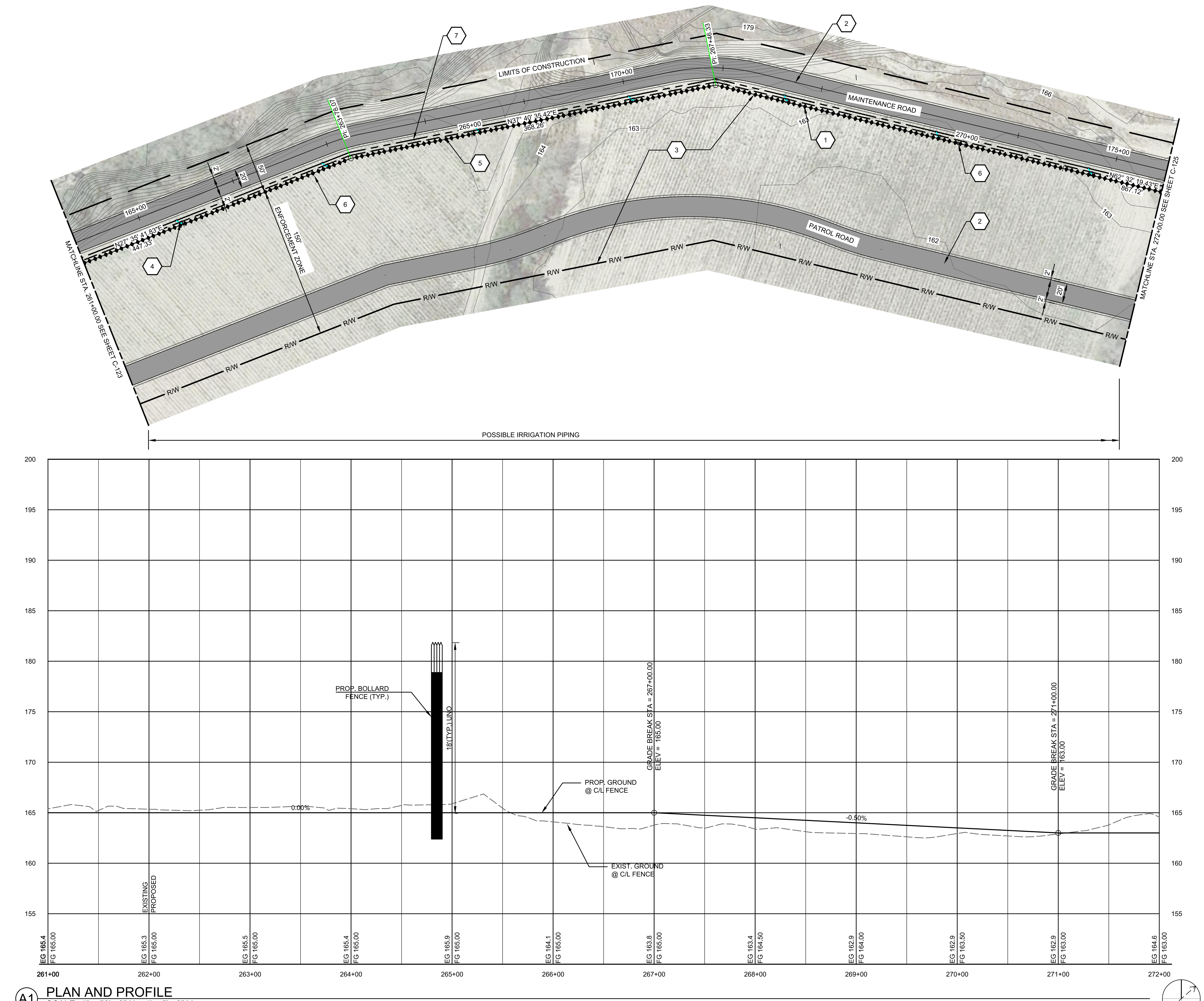
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 250+00.00 - 161+00.00

SHEET ID
ROMA
C-123



A1 PLAN AND PROFILE
SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

1' = 50' - 0" 1' = 5' - 0"

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13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

MARK | DESCRIPTION | DATE

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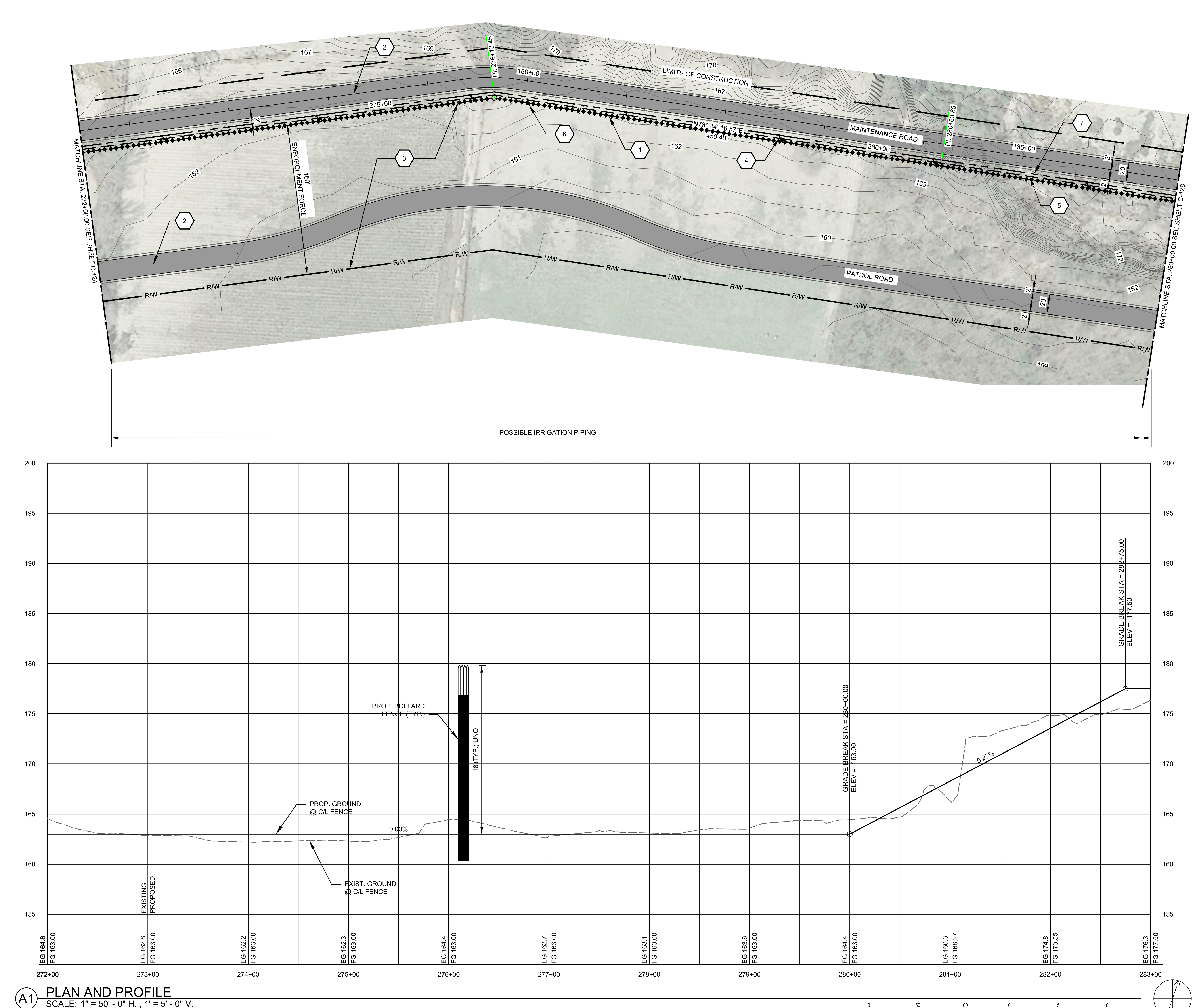
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 261+00.00 - 272+00.00

SHEET ID
ROMA
C-124



A1 PLAN AND PROFILE

SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

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US Army Corps of Engineers ®

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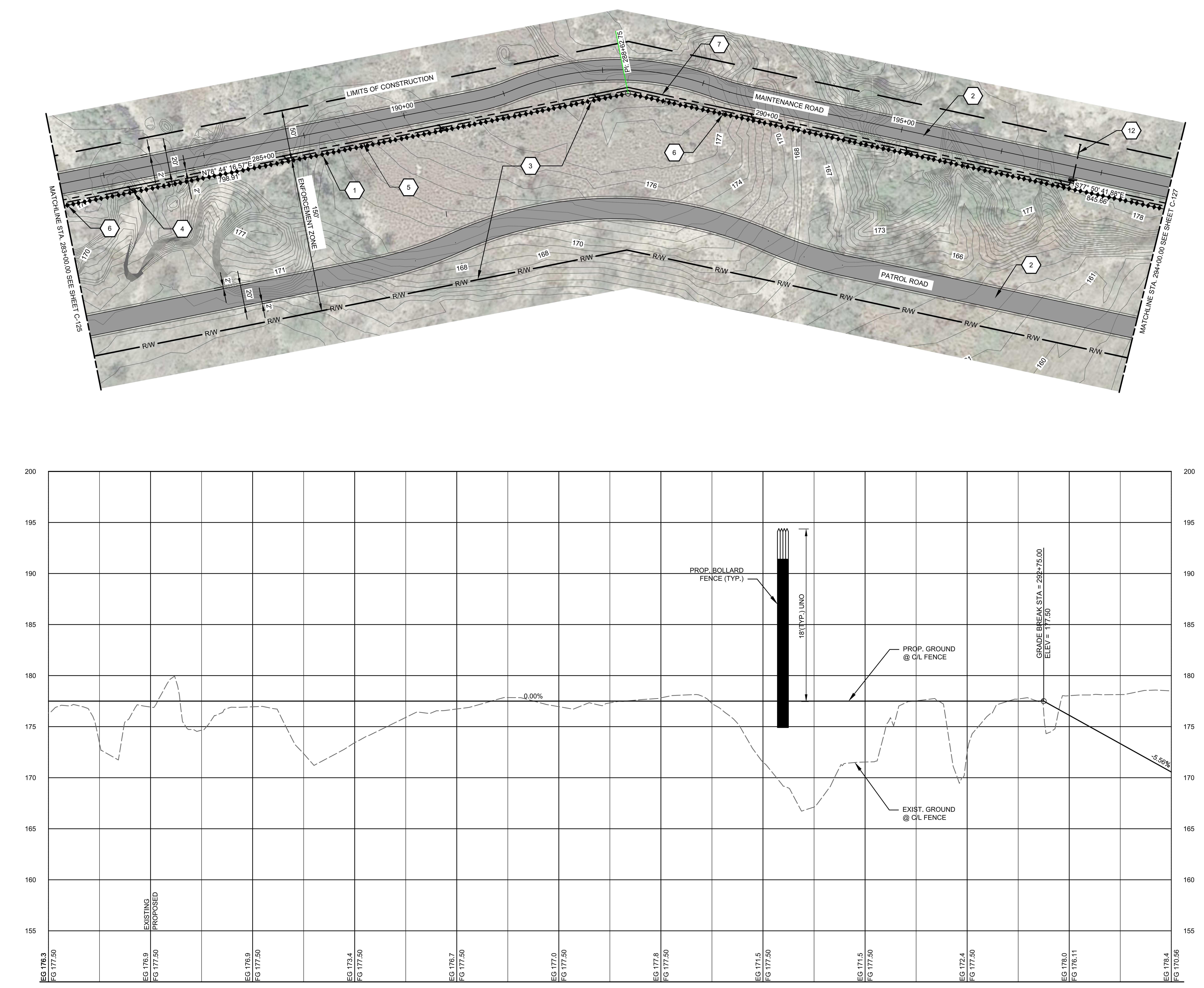
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 272+00.00 - 283+00.00

SHEET ID
ROMA
C-125



A1 PLAN AND PROFILE
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1" = 50' - 0"
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US Army Corps of Engineers ®

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US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
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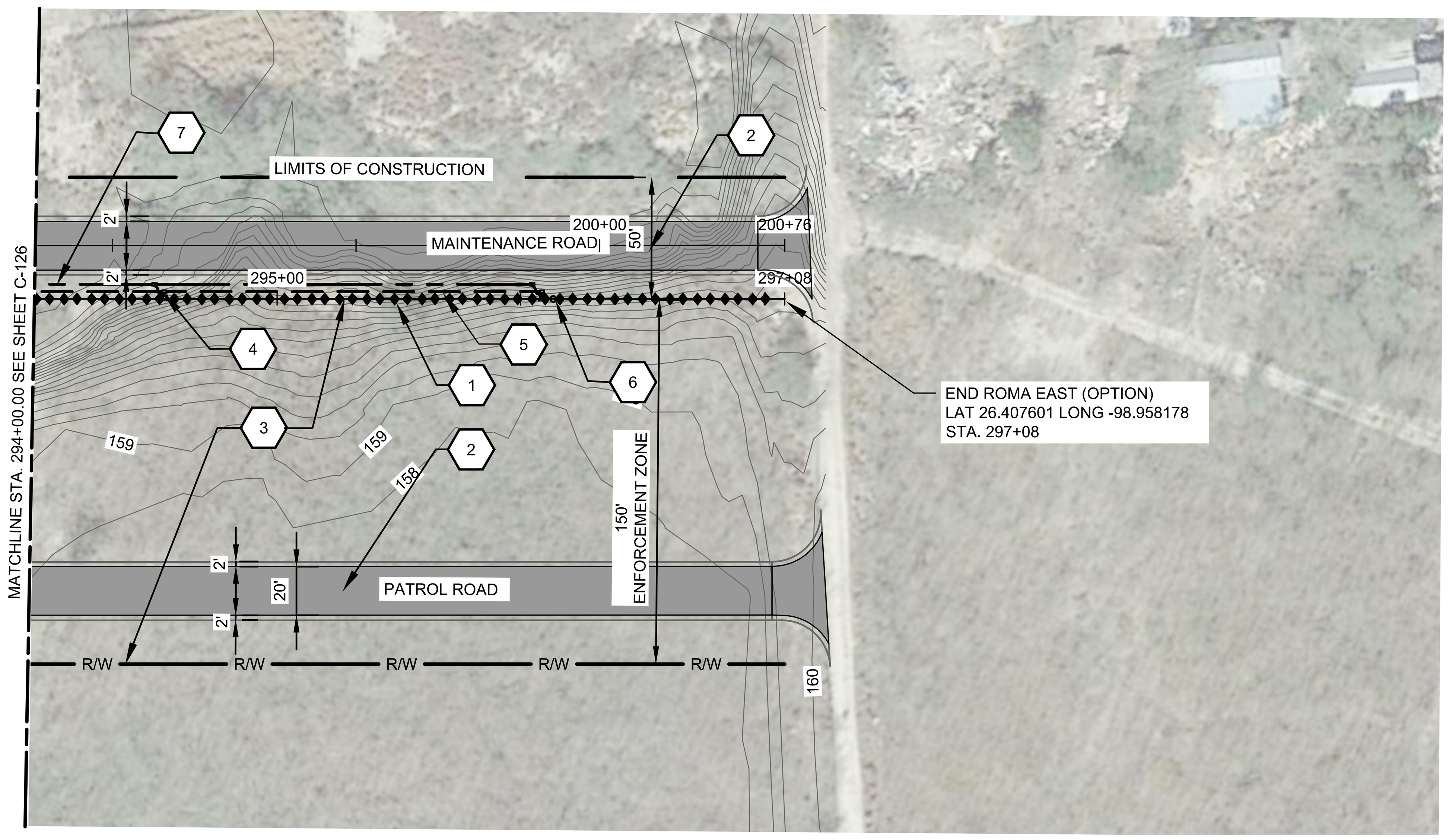
GALVESTON, TX 77553-1229

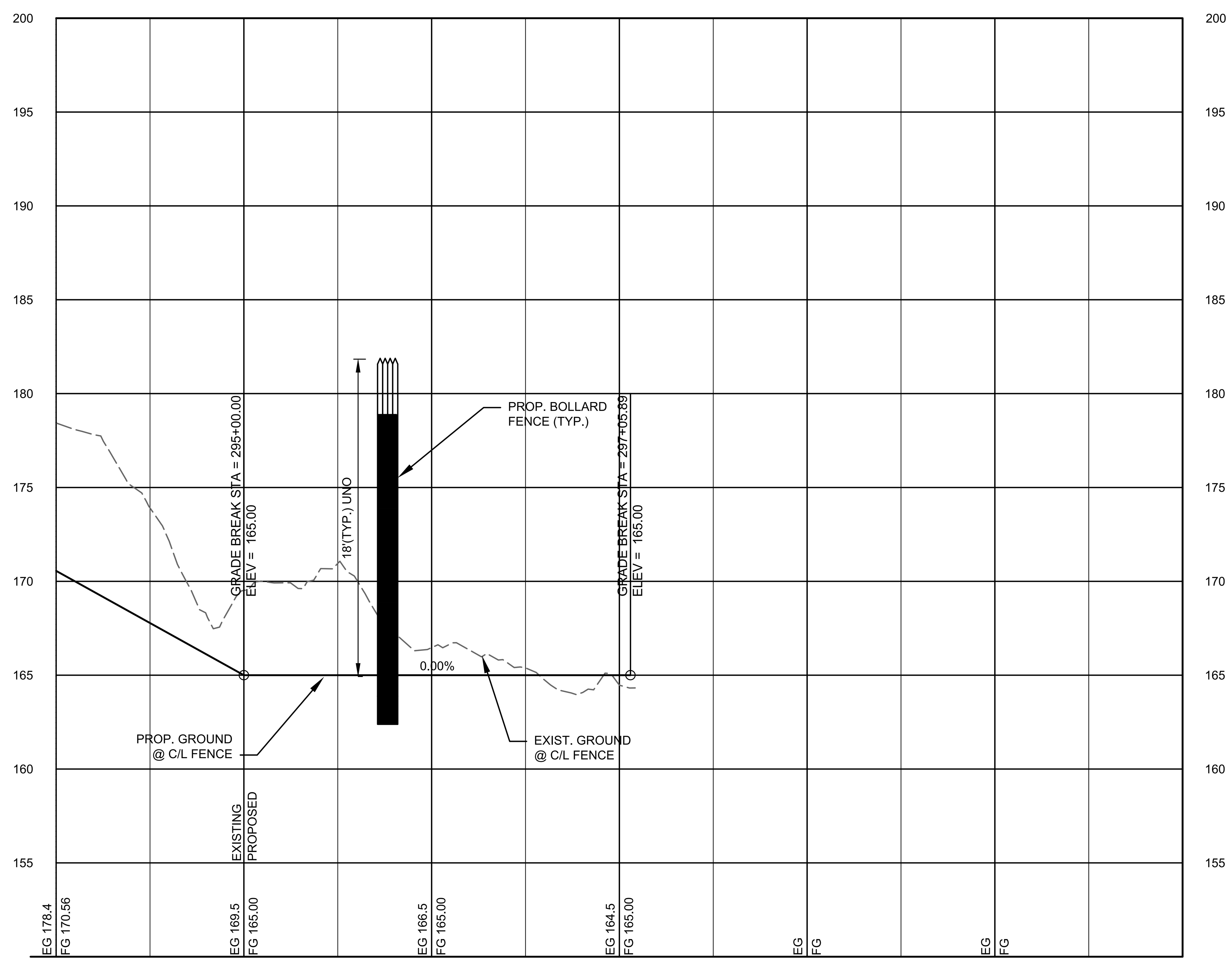
ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 283+00.00 - 294+00.00

SHEET ID
ROMA
C-126





A1 PLAN AND PROFILE
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0 50 100 1' = 50' - 0"   0 5 10 1' = 5' - 0"

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2. CONTRACTOR IS RESPONSIBLE FOR PERFORMING ALL GEOTECHNICAL TESTING, TOPOGRAPHIC MAPPING, DESIGN, SURVEY STAKE-OUT, ABOVE AND BELOW GROUND UTILITY IDENTIFICATIONS AND REQUIRED RELOCATIONS, AND REMOVAL AND PROPER DISPOSAL OF STRUCTURES, DEBRIS, ETC. LOCATED WITHIN THE ENFORCEMENT ZONE.
3. CONTRACTOR SHALL ENSURE THAT ALL DESIGNS MEET TACTICAL INFRASTRUCTURE STANDARDS, LATEST EDITION.
4. CONTRACTOR SHALL VERIFY LOCATION OF ALL UTILITIES, IRRIGATION CULVERTS AND DRAINAGE STRUCTURES, AND ADJUST/RELOCATE AS REQUIRED TO DE-CONFLICT WITH THE PROPOSED BOLLARD FENCE AND ENFORCEMENT ZONE (I.E.: EX. IRRIGATION VALVES TO BE RELOCATED TO NORTH LEVEE EMBANKMENT).
5. CONTRACTOR SHALL DESIGN AND INSTALL ALL DRAINAGE SYSTEMS FOR THIS PROJECT.
6. LIGHTING LOCATIONS ARE CONCEPTUAL. CONTRACTOR TO PROVIDE FINAL LIGHTING COMPUTATIONS AND LOCATIONS.

XX KEYNOTES

1. PROPOSED NEW TYPE P-3 BOLLARD FENCE.
2. PROPOSED TYPE FC-2 AGGREGATE ALL-WEATHER ROAD.
3. CLEAR VEGETATION AND GRADE WITHIN ENFORCEMENT ZONE.
4. PROPOSED LIGHT POLE, PULLBOX, AND LIGHTING - SEE ELEC. FOR LOCATIONS. (TYP.)
5. PROPOSED POWER AND LIGHTING DISTRIBUTION CABLE AND CONDUIT/DUCTBANK.
6. PROPOSED FENCE GROUNDING LOCATIONS.
7. PROPOSED COMMUNICATION CONDUIT/ DUCTBANK. (CABLE FUTURE BY OTHERS)
8. GATE ELECTRICAL DISTRIBUTION EQUIPMENT.
9. GATE GROUNDING LOCATIONS.
10. PROPOSED MOTORIZED VEHICLE SLIDE GATE.
11. PROPOSED RVSS SITE.
12. CONCEPTUAL ELECTRICAL UTILITY CONNECTION POINT.
13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

ISSUED DATE: | SOLICITATION NO: | CONTRACT NO.: | FILE NUMBER:

DESIGNED BY: X | DRAWN BY: X | CHECKED BY: X | SUBMITTED BY: X | SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
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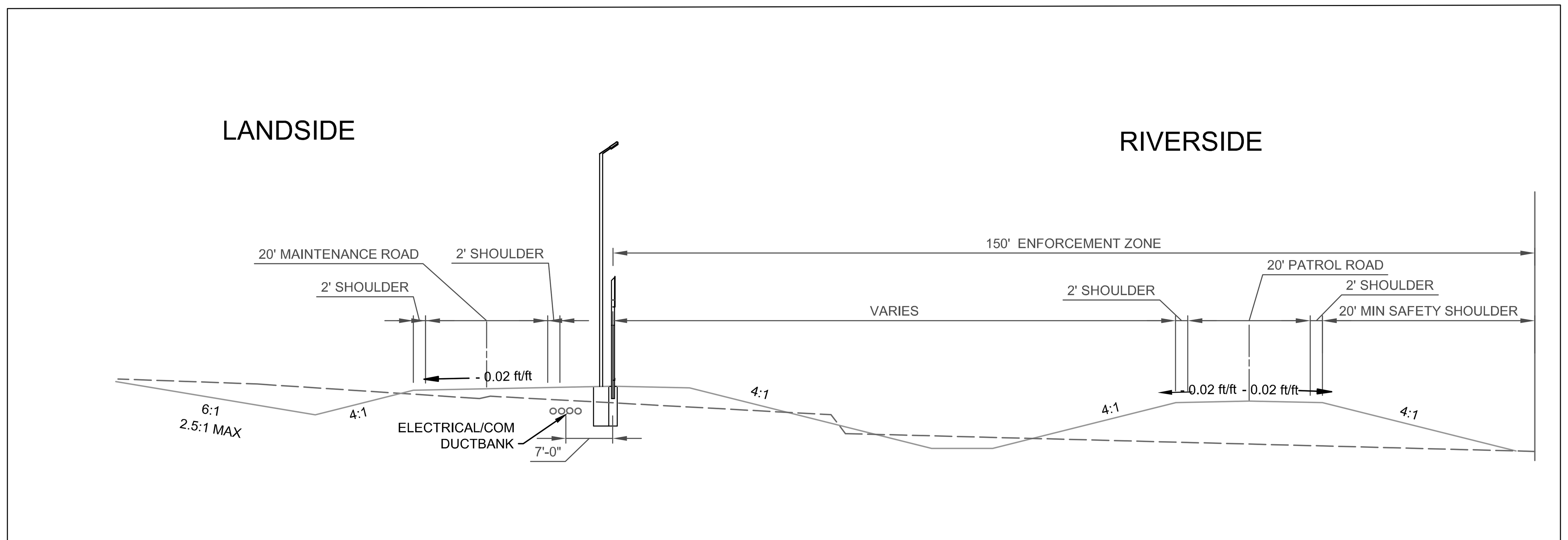
DALLAS, TX, 75252

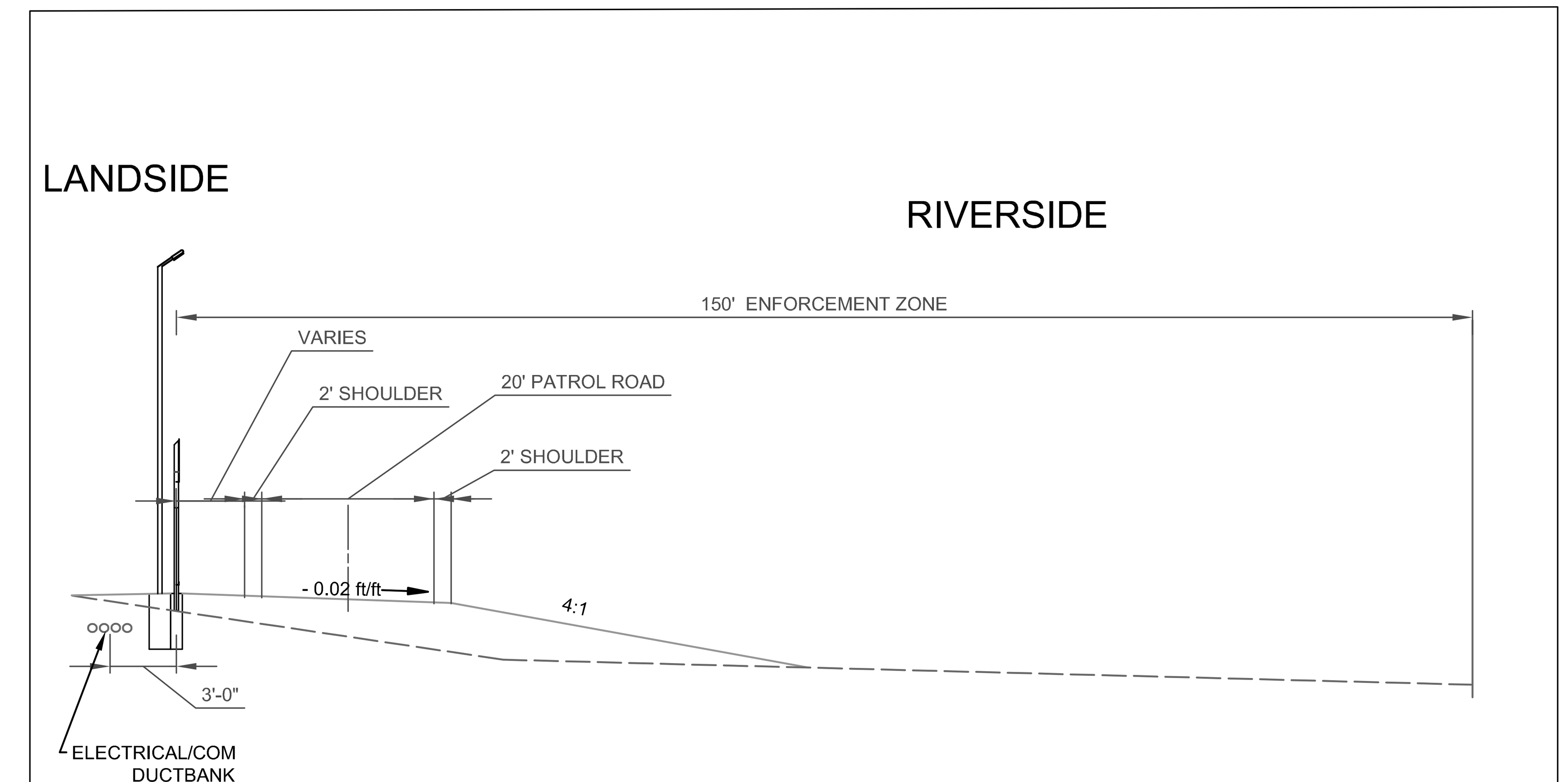
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 294+00.00 - 299+27.24

SHEET ID
ROMA
C-127



TYPICAL - 1



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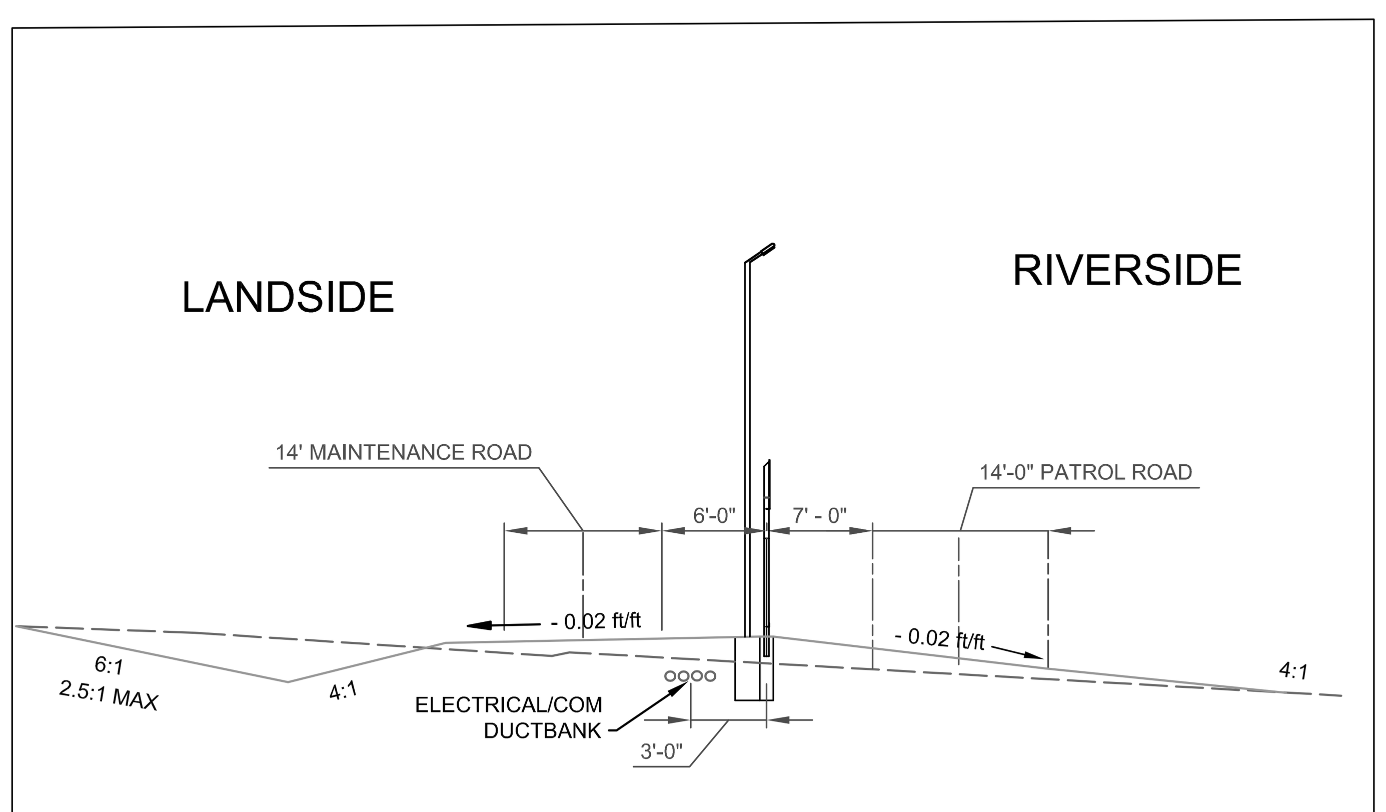

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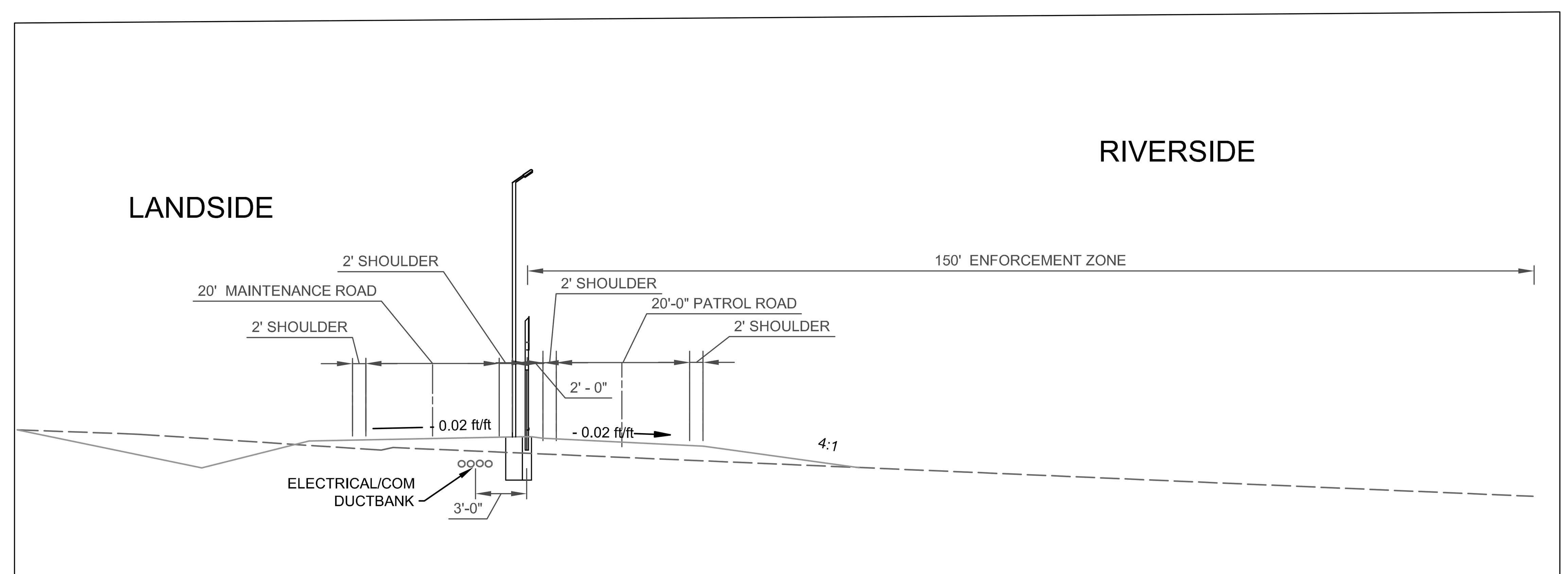

TYPICAL - 4

A1 TYPICAL CROSS SECTIONS
SCALE: 1" = 200'

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

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SUBMITTED BY: X
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US ARMY CORPS OF ENGINEERS
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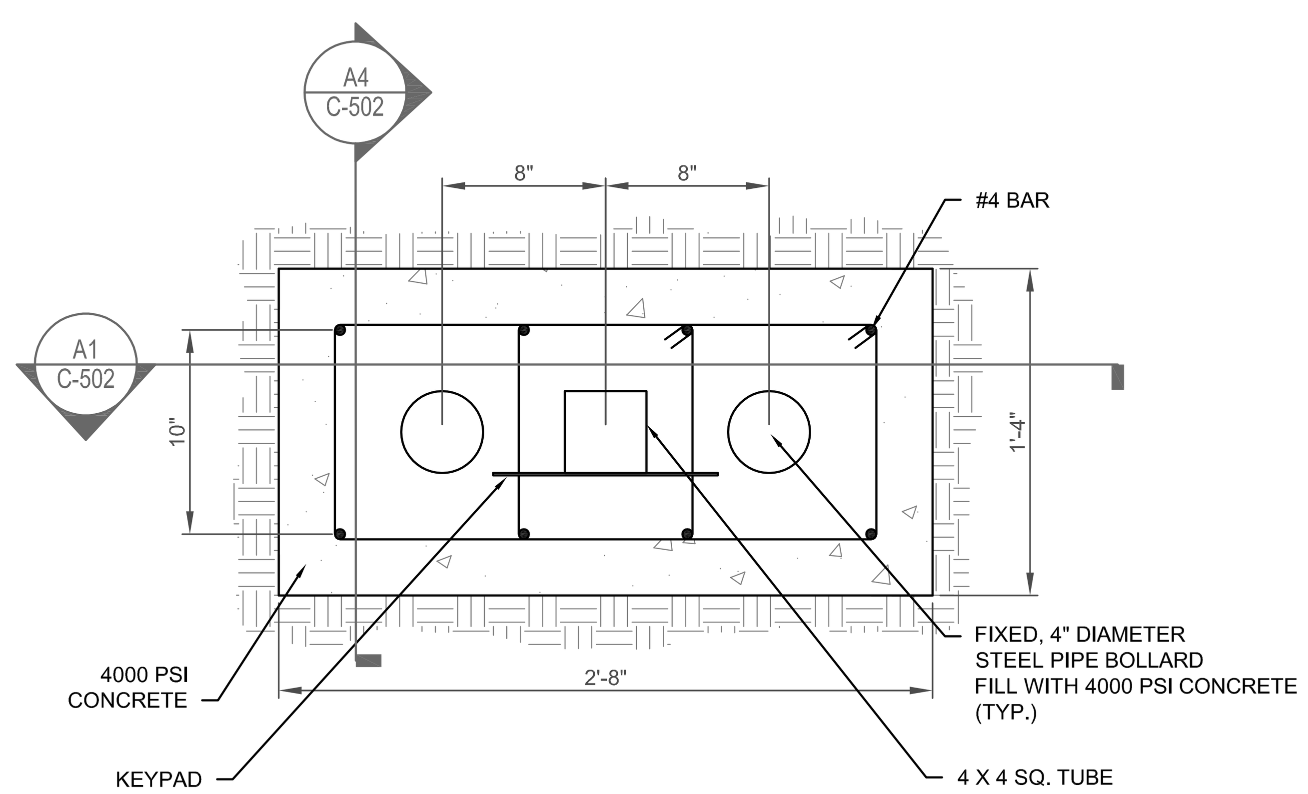
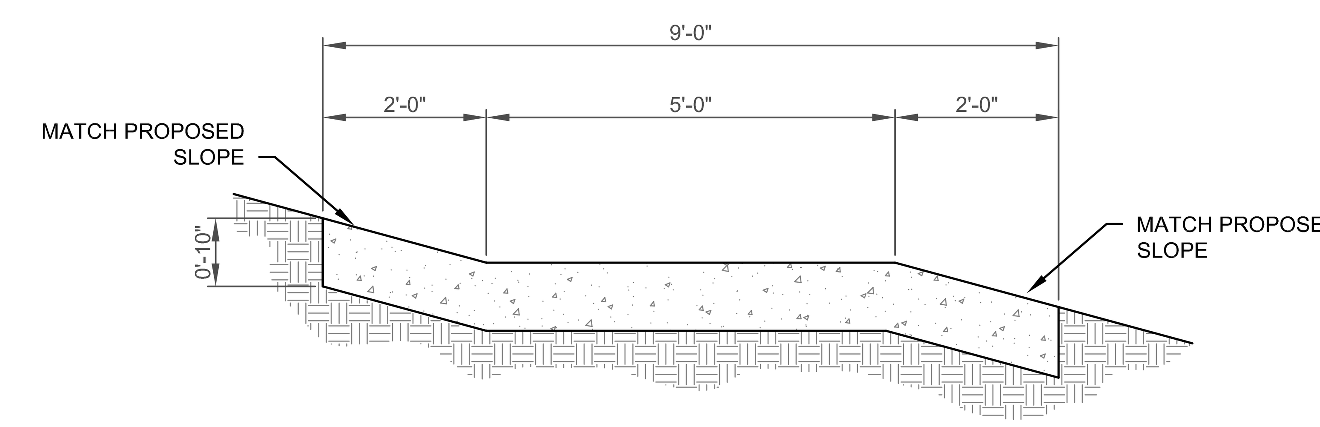
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE
TYPICAL CROSS SECTION

SHEET ID
ROMA
C-301

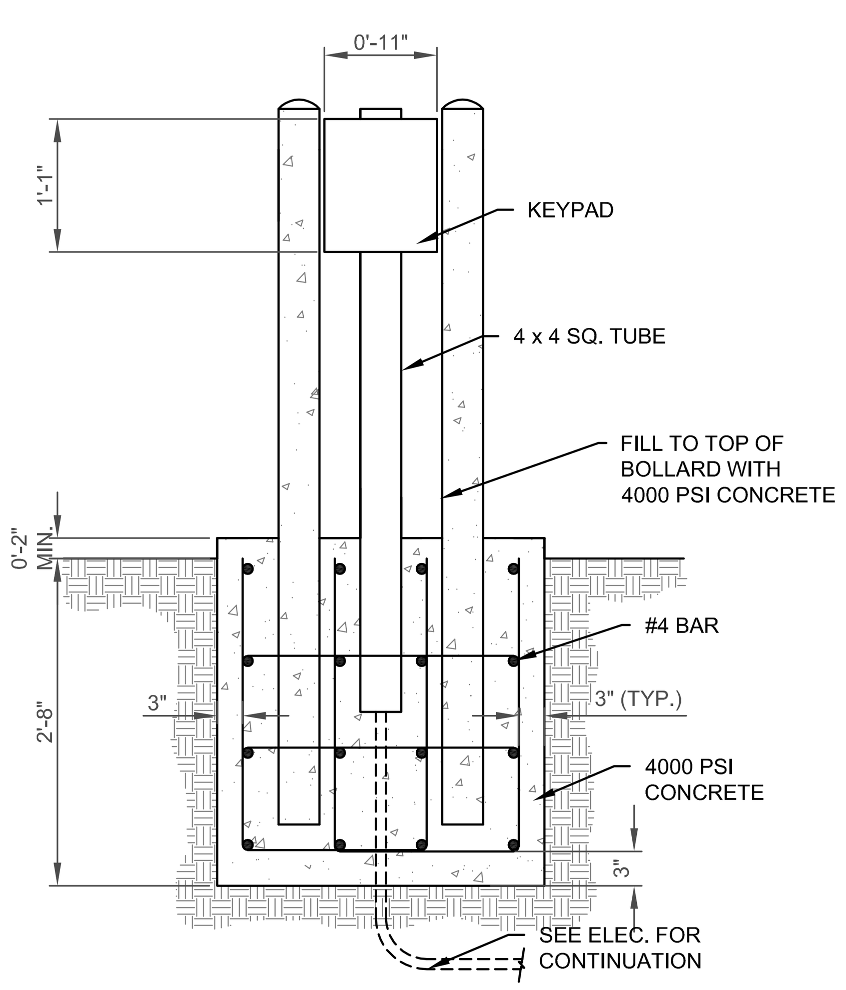
GENERAL NOTES



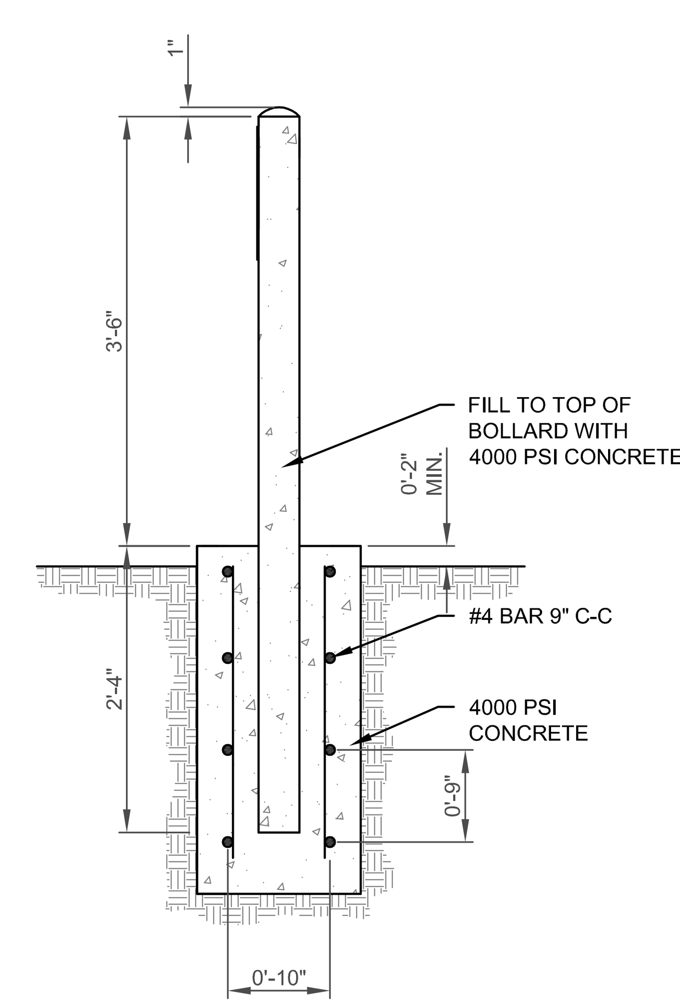
D1 KEYPAD MOUNTING DETAIL
SCALE: N.T.S.



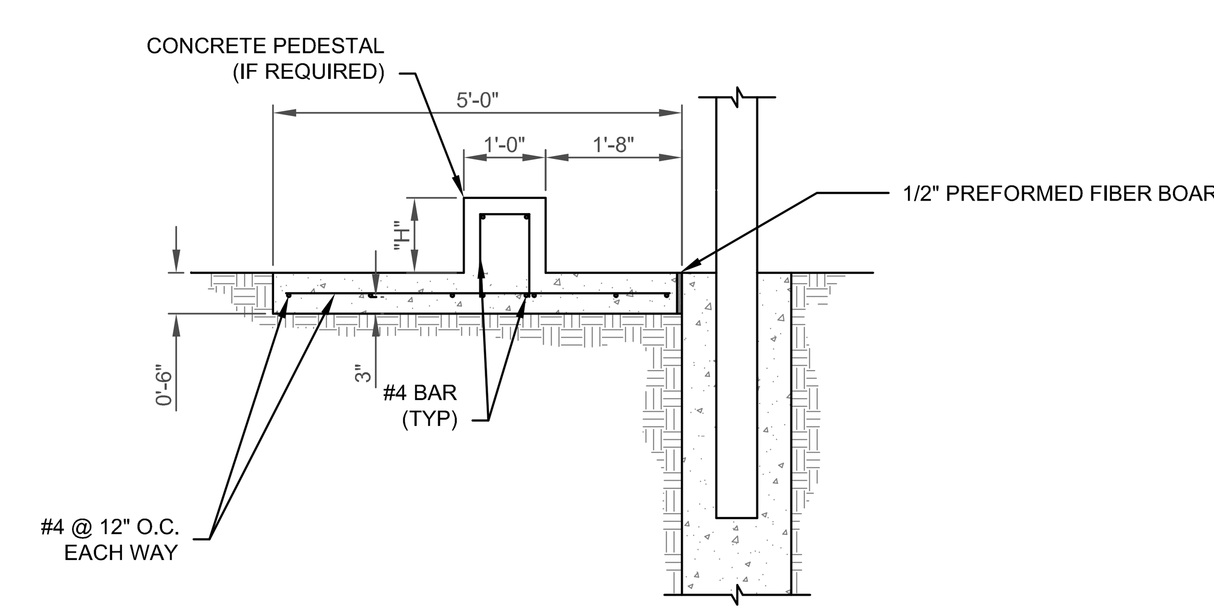
C6 10" CONCRETE ROAD CROSSING SLAB
SCALE: N.T.S.



A1 KEYPAD MOUNTING DETAIL
SCALE: N.T.S.



A4 KEYPAD MOUNTING DETAIL
SCALE: N.T.S.



A6 6" CONCRETE SLAB
SCALE: N.T.S.

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MARK	DESCRIPTION	DATE

ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

DESIGNED BY: B.PRESTON
DRAWN BY: B.DUNNE
CHECKED BY: B.PRESTON
SUBMITTED BY: B.PRESTON
SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
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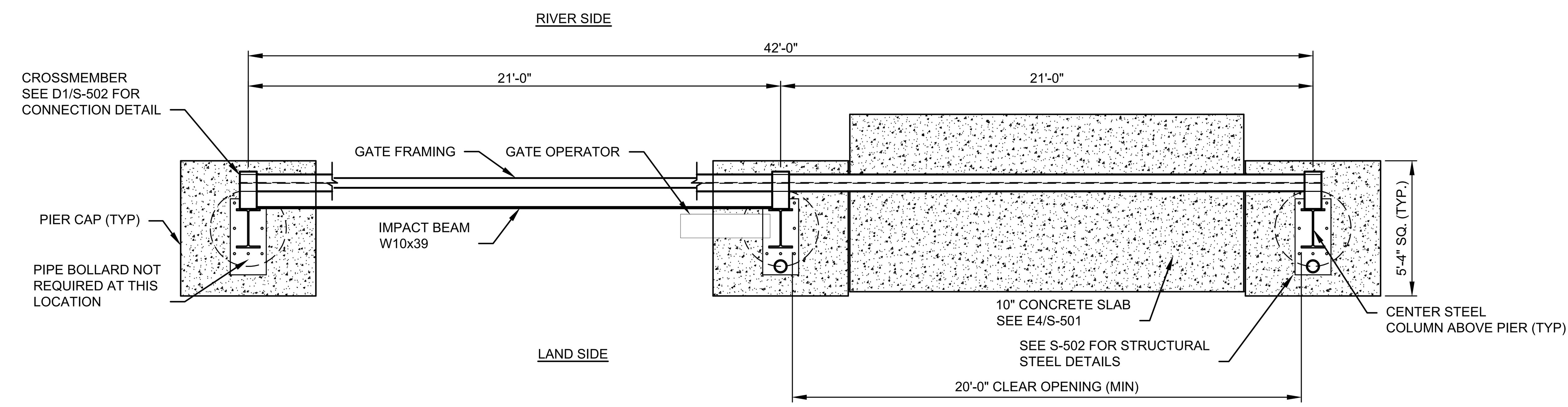
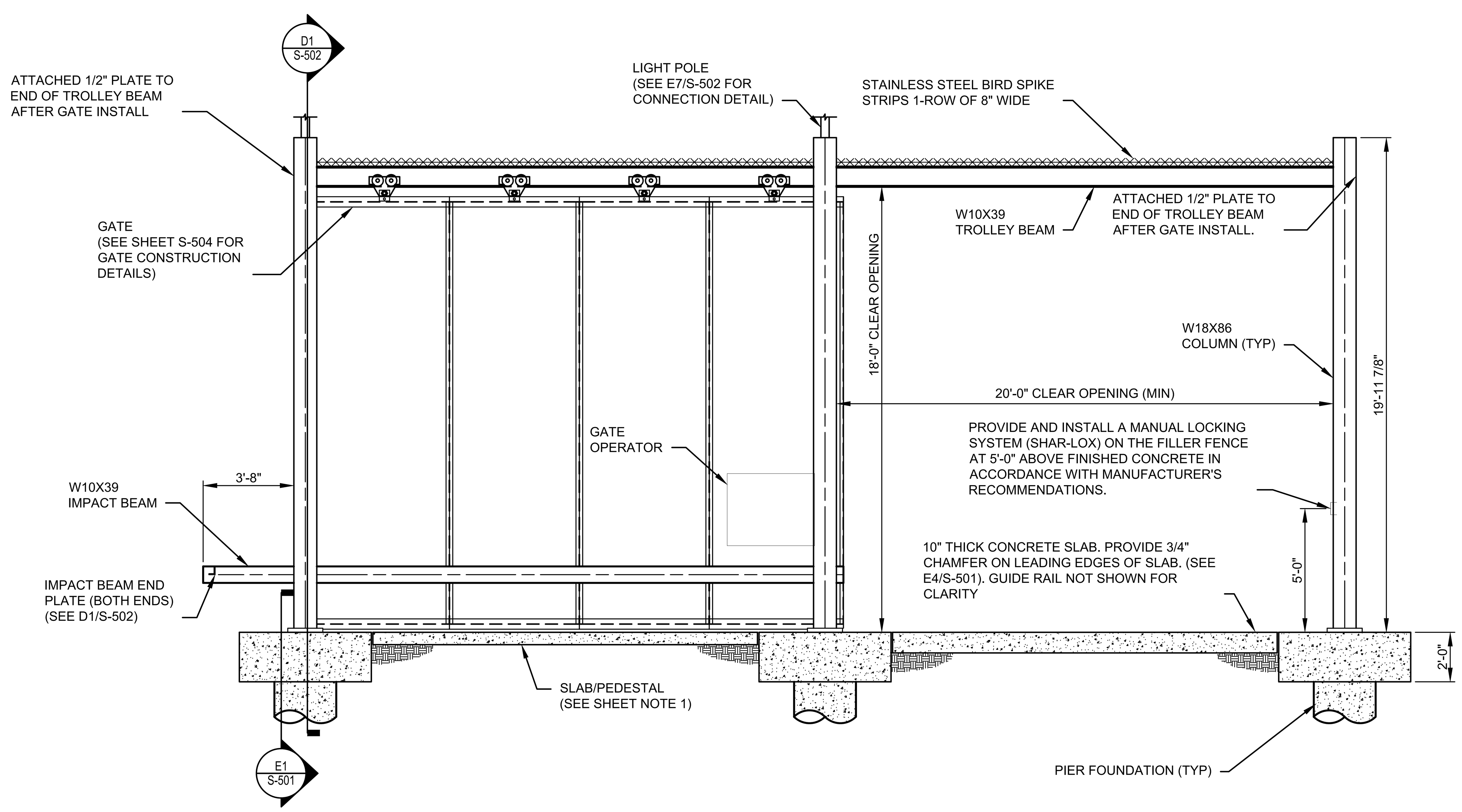
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

ROAD CROSSING AND KEYPAD MOUNT DETAILS

SHEET ID
ROMA
C-501



E2 PLAN - 20 FT. AUTOMATED GATE
SCALE: N.T.S.



A2 ELEVATION - 20 FT. AUTOMATED GATE (LOOKING TOWARD RIVER SIDE)
SCALE: N.T.S.

GENERAL NOTES

1. FOR BASE PLATE AND BOLT DETAIL REFER TO DRAWING S-501 AND S-502.
2. FOR GATE OPERATOR PLATFORM REFER TO DRAWING S-503.
3. PROVIDE STEEL PLATES, WELDED TO TOP OF COLUMNS #1 AND #2 AND BOLTED TO THE LIGHT POST BASEPLATE. SEE DETAIL E7/S-502 FOR DETAILS.
4. ANY GAP BETWEEN FENCE AND GATE SHALL BE NO MORE THAN 4".
5. EARTHWORK SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 31 00 00.
6. INSTALL 1 1/2" DIA GALVANIZED STEEL LADDER TO ACCESS GATE OPERATOR. LADDER RUNGS SHALL BE EQUALLY SPACE (8") 1" SQ GALVANIZED STEEL BARS WITH NON-SLIP TREATMENT ON TOP OF EACH RUNG. PAINT WELDED SURFACES WITH A CORROSION PROTECTIVE COATING AS NEEDED.
7. MINIMUM LADDER OPENING IS 16" IN WIDTH.

SHEET NOTES

1. SEE SHEET C-501 FOR CROSSING SLAB INFORMATION.
2. SEE SHEET C-501 FOR 6" CONCRETE SLAB INFORMATION.

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MARK	DESCRIPTION	DATE

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SIZE: ANSI D
ISSUED DATE:
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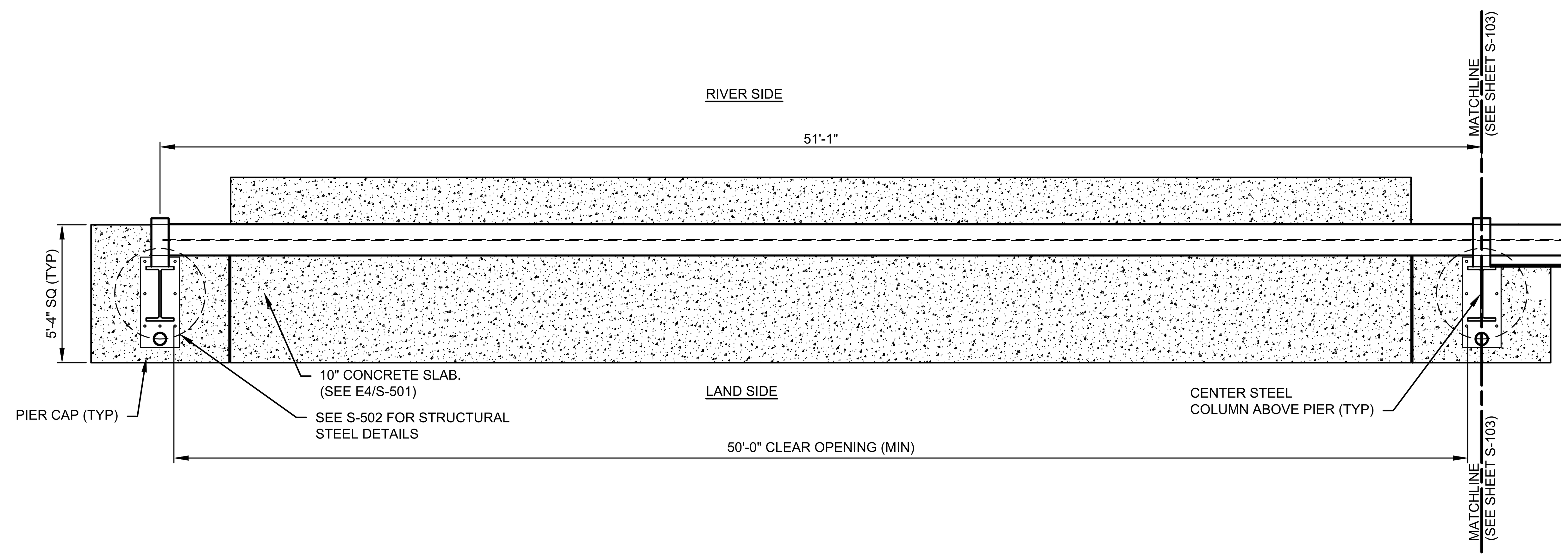
DALLAS, TX, 75252

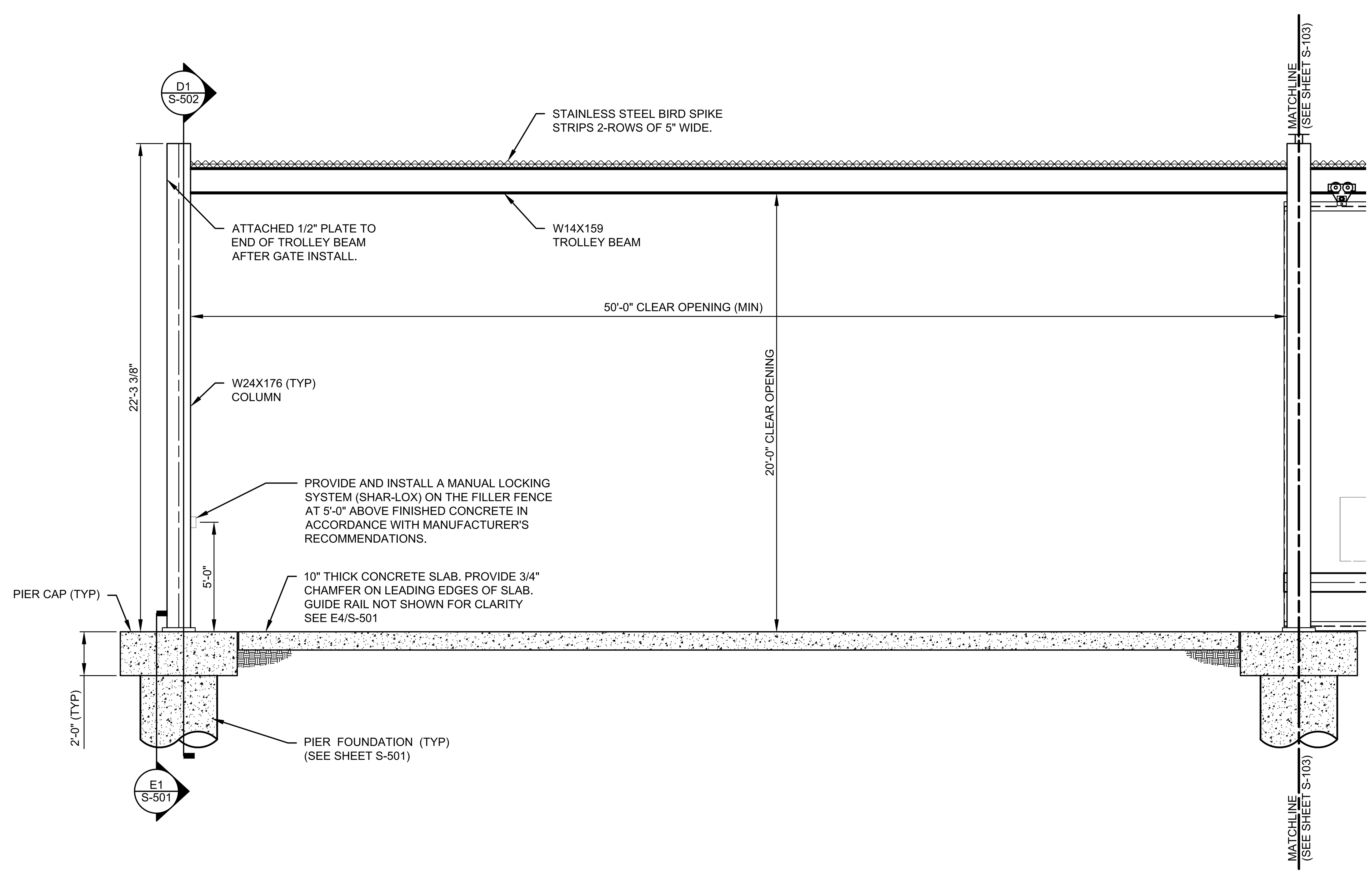
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND ELEVATION
20 FT. GATE

SHEET ID
ROMA
S-101



E2 PLAN - 50 FT. AUTOMATED GATE
SCALE: N.T.S



A2 ELEVATION - 50 FT. AUTOMATED GATE (LOOKING TOWARD RIVER SIDE)
SCALE: N.T.S

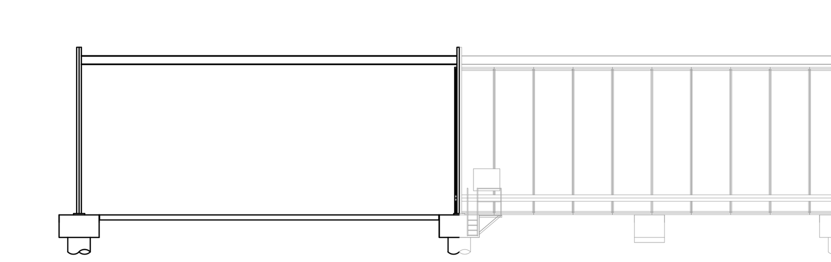
GENERAL NOTES

1. FOR BASE PLATE AND BOLT DETAIL REFER TO DRAWING S-501 AND S-502.
2. FOR GATE OPERATOR PLATFORM REFER TO DRAWING S-503.
3. PROVIDE STEEL PLATES, WELDED TO TOP OF COLUMNS #1 AND #2 AND BOLTED TO THE LIGHT POST BASEPLATE. SEE DETAIL E7/S-502 FOR DETAILS.
4. ANY GAP BETWEEN FENCE AND GATE SHALL BE NO MORE THAN 4".
5. EARTHWORK SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 31 00 00.
6. INSTALL 1 1/2" DIA GALVANIZED STEEL LADDER TO ACCESS GATE OPERATOR. LADDER RUNGS SHALL BE EQUALLY SPACE (8") 1" SQ GALVANIZED STEEL BARS WITH NON-SLIP TREATMENT ON TOP OF EACH RUNG. PAINT WELDED SURFACES WITH A CORROSION PROTECTIVE COATING AS NEEDED.
7. MINIMUM LADDER OPENING IS 16" IN WIDTH.

SHEET NOTES

1. SEE SHEET C-501 FOR CROSSING SLAB INFORMATION.

KEYPLAN



US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

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SIZE: ANSI D
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FILE NUMBER:

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
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GALVESTON, TX 77553-1229

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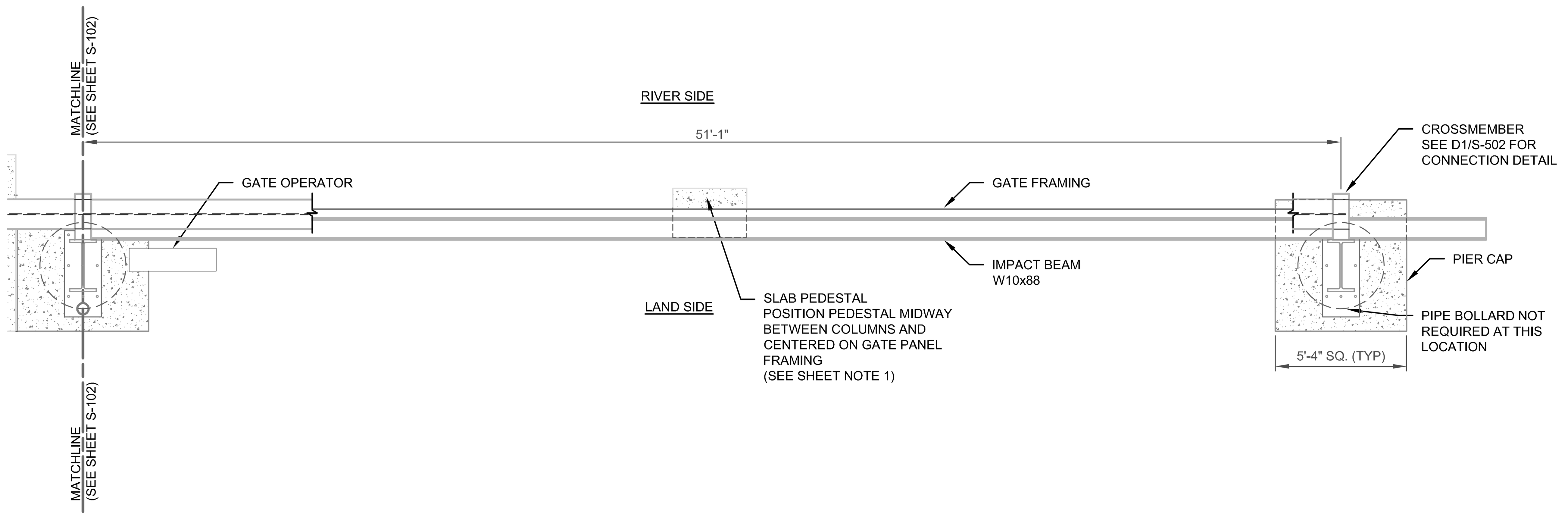
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

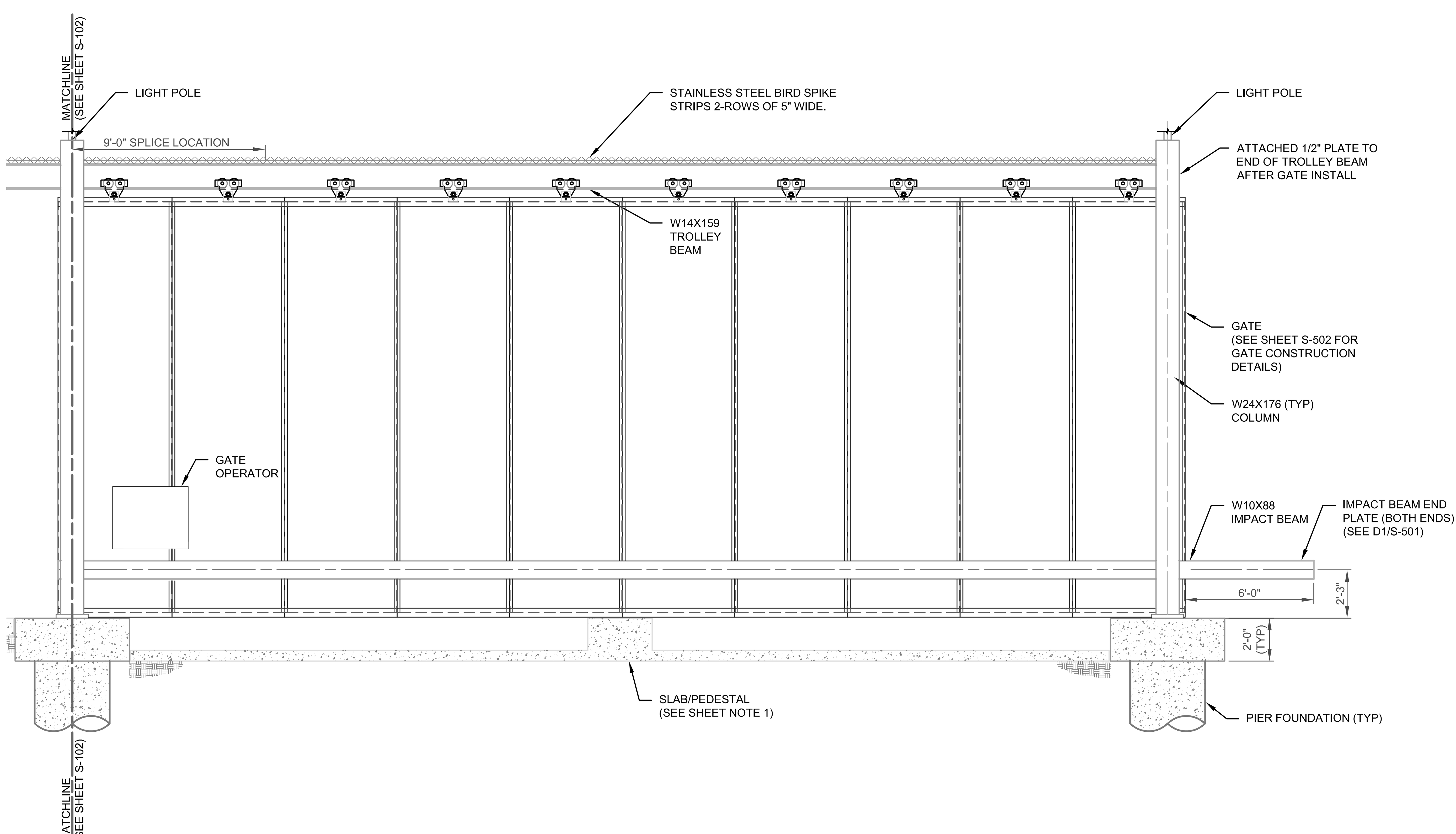
PLAN AND ELEVATION
50 FT. GATE

SHEET ID
ROMA
S-102

1 2 3 4 5 6 7 8 9 10



E2 PLAN - 50 FT. AUTOMATED GATE
SCALE: N.T.S.



A2 ELEVATION - 50 FT. AUTOMATED GATE (LOOKING TOWARD RIVER SIDE)
SCALE: N.T.S.

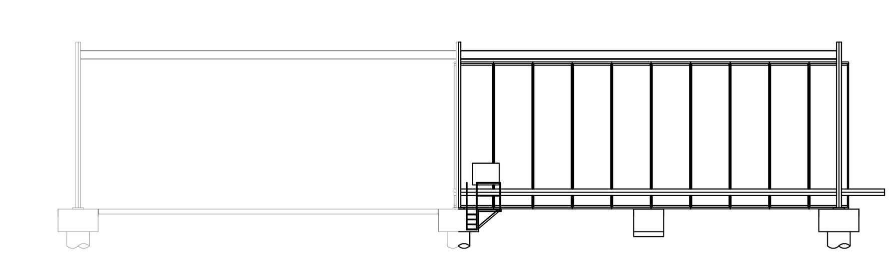
GENERAL NOTES

1. SEE S-102.

SHEET NOTES

1. SEE SHEET C-501 FOR SLAB PEDESTAL INFORMATION WHERE REQUIRED.

KEYPLAN



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FILE NUMBER:

DESIGNED BY: X
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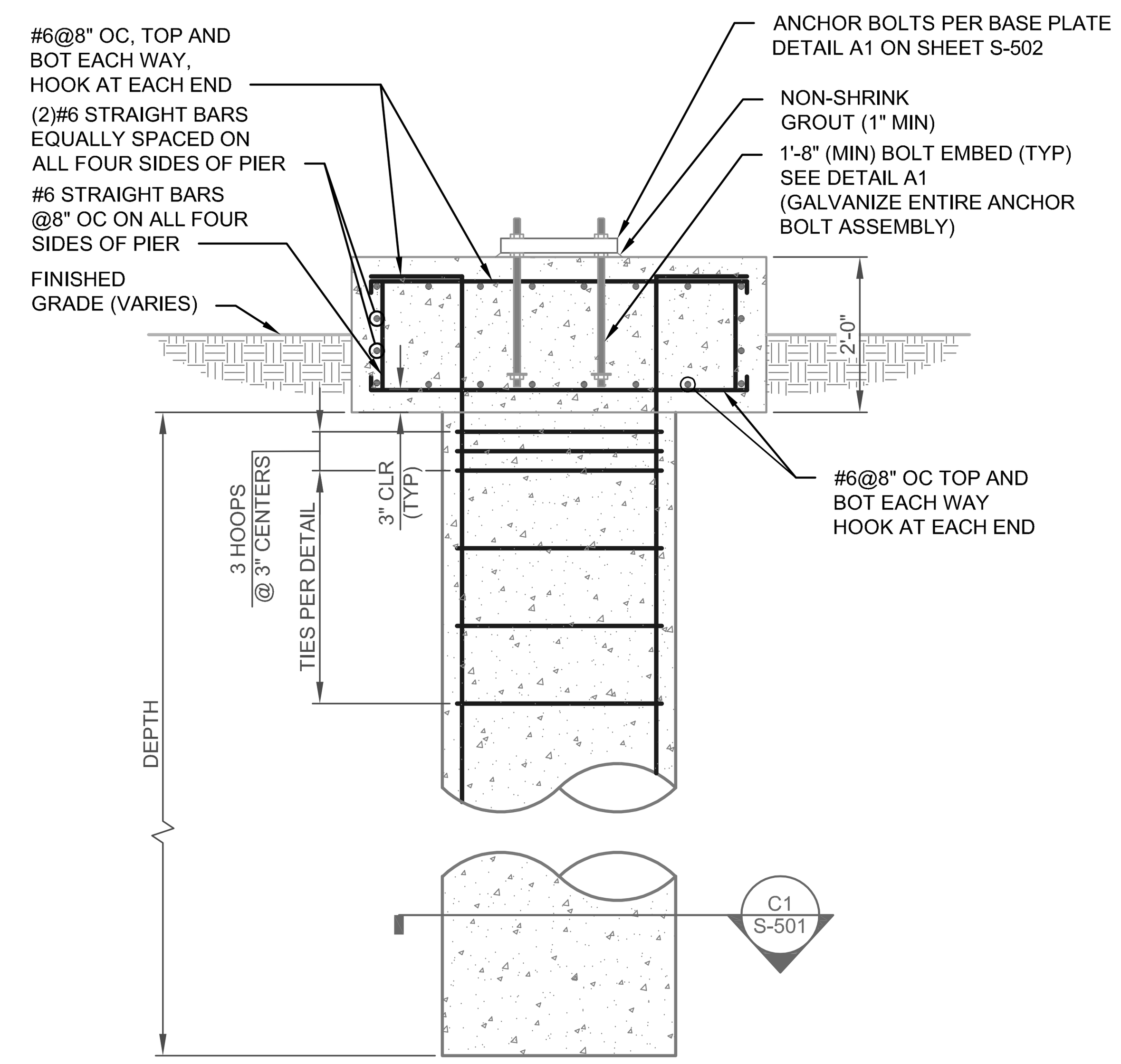
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

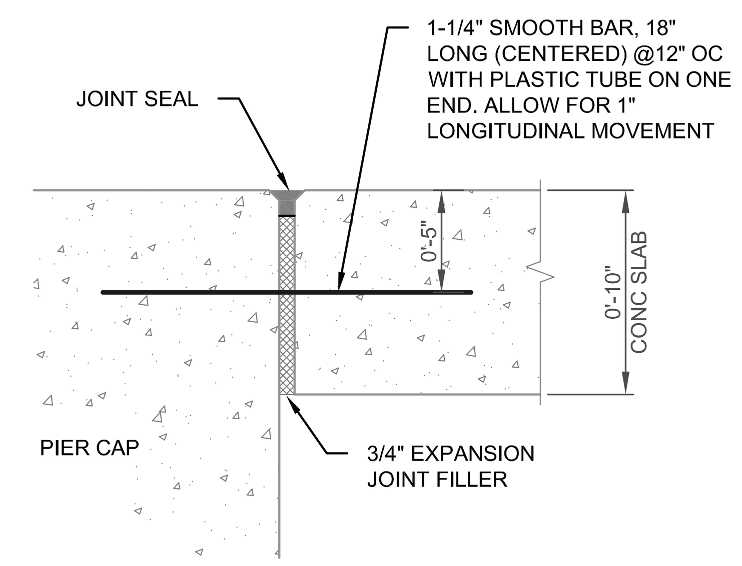
PLAN AND ELEVATION
50 FT. GATE

SHEET ID
ROMA
S-103

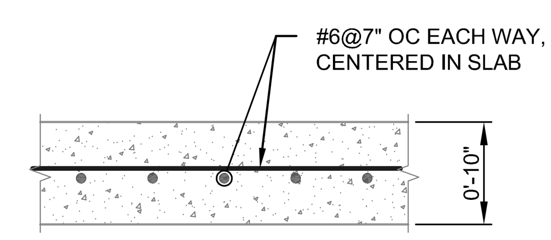
G F E D C B A



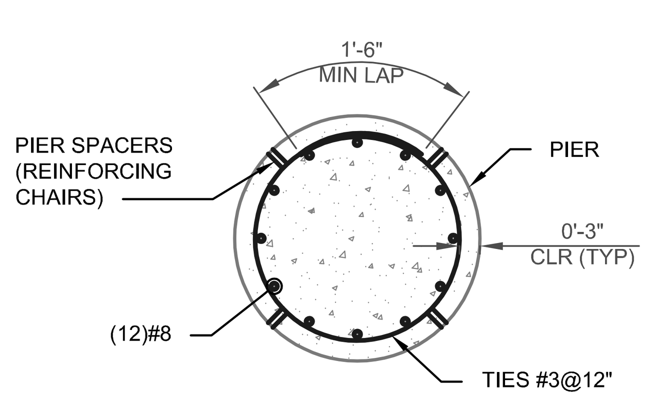
E1 PIER FOUNDATION / PILE CAP REINFORCING DETAIL
SCALE: N.T.S.



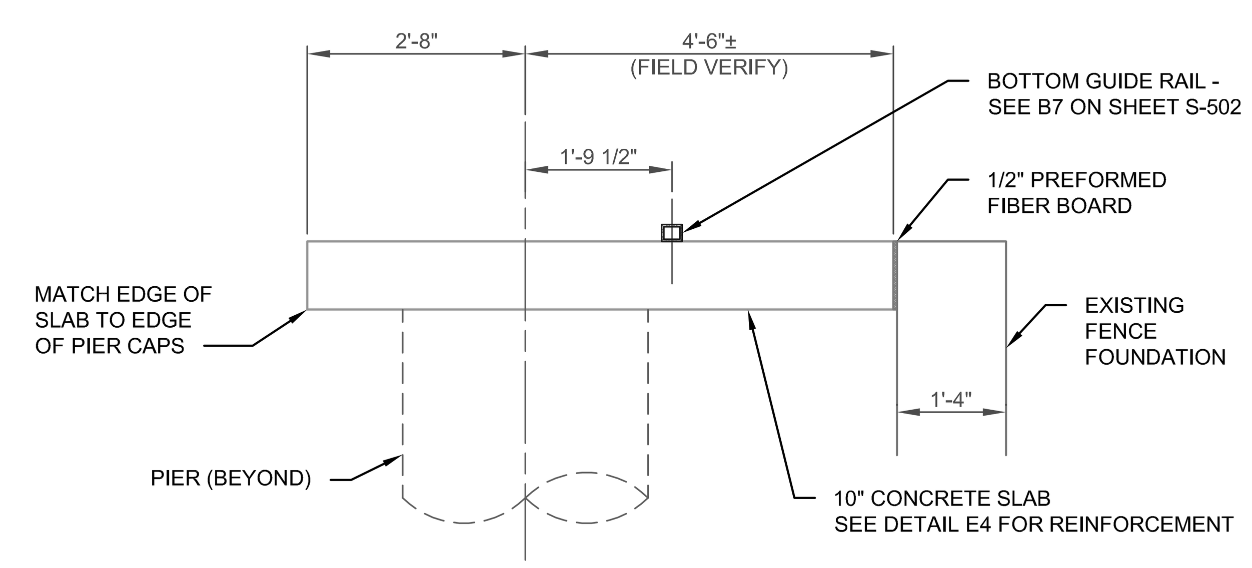
F4 SLEEVED EXPANSION JOINT
SCALE: N.T.S.



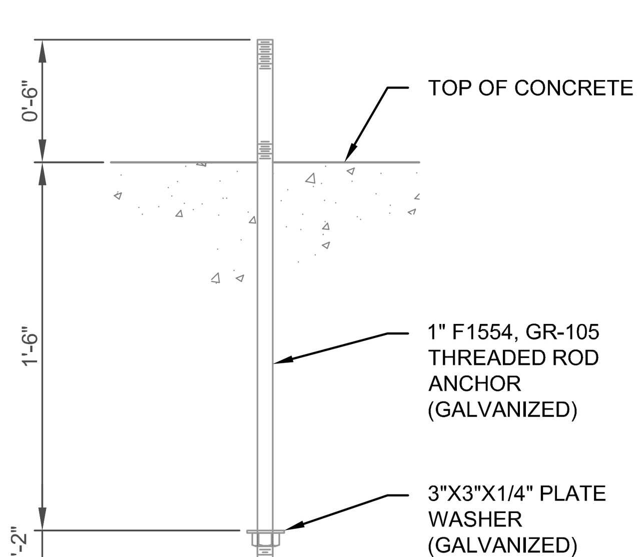
E4 CONCRETE SLAB REINFORCING
SCALE: N.T.S.



C1 PIER FOUNDATION SECTION
SCALE: N.T.S.



C4 CONCRETE SLAB SIZING DETAIL
SCALE: N.T.S.



A1 ANCHOR BOLT DETAIL
SCALE: N.T.S.

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MARK	DESCRIPTION	DATE

DESIGNED BY: X
DRAWN BY: X
CHECKED BY: X
SUBMITTED BY: X
SIZE: ANSI D
ISSUED DATE:
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GALVESTON, TX 77553-1229

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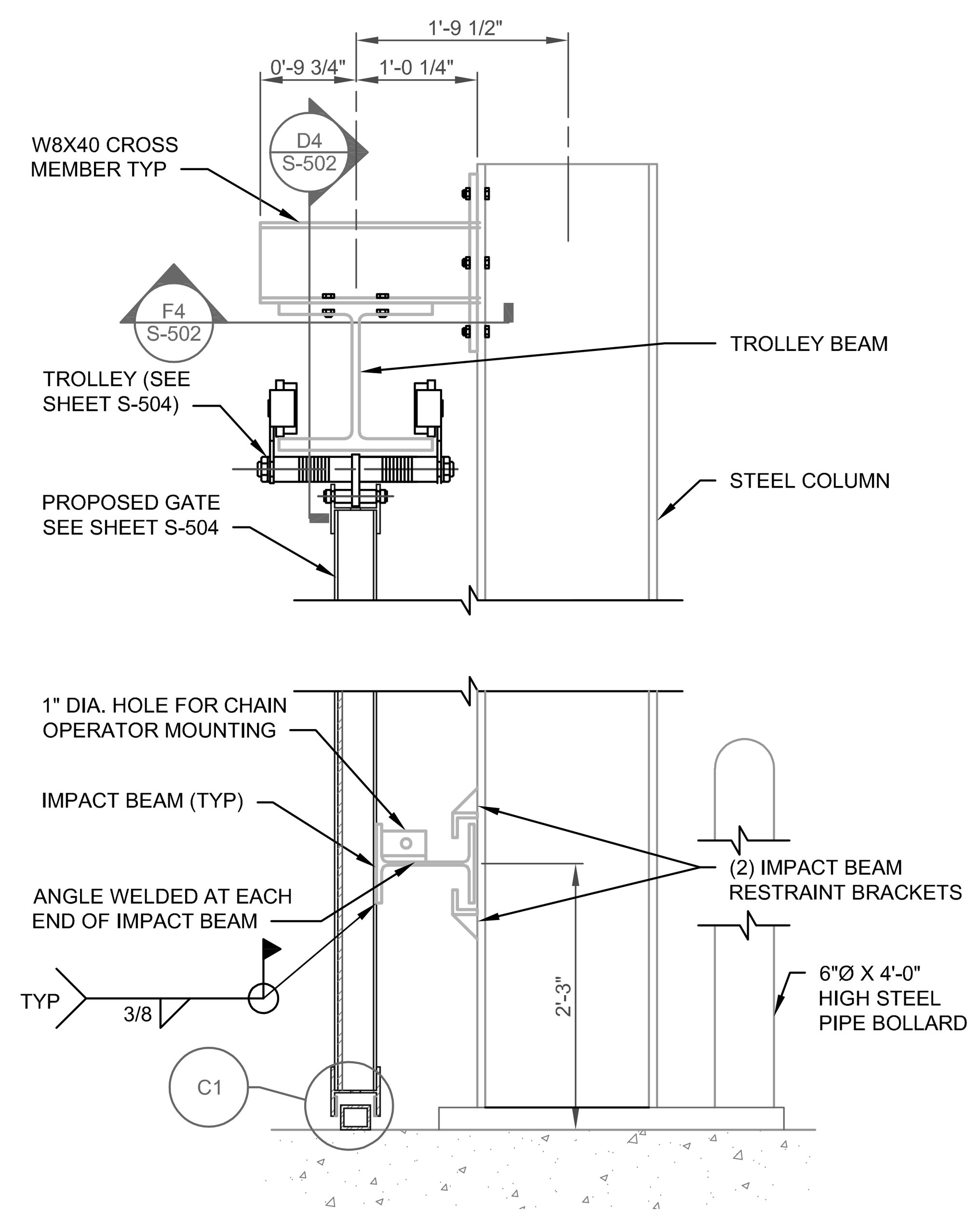
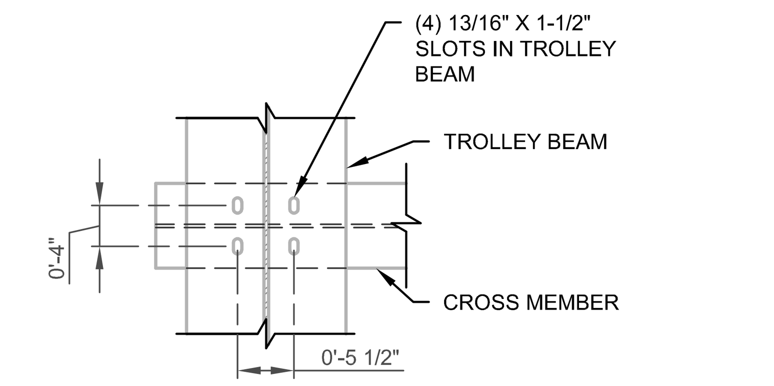
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE
CONCRETE DETAILS

SHEET ID
ROMA
S-501



D1 STRUCTURAL COLUMN SECTION
SCALE: N.T.S.



F4 DETAIL
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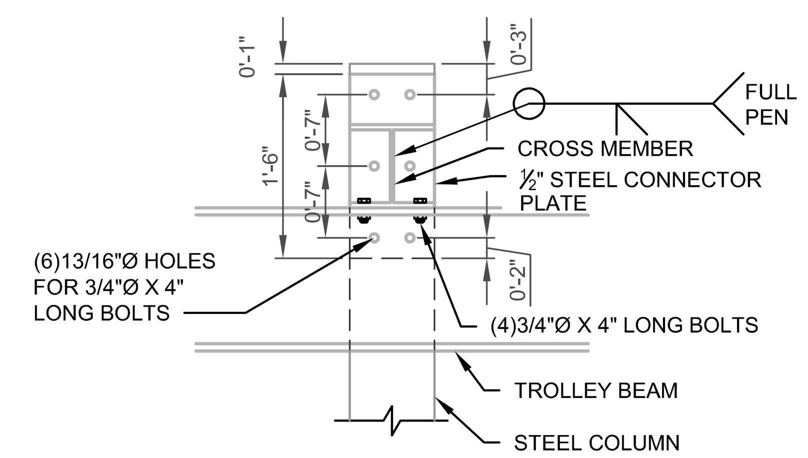
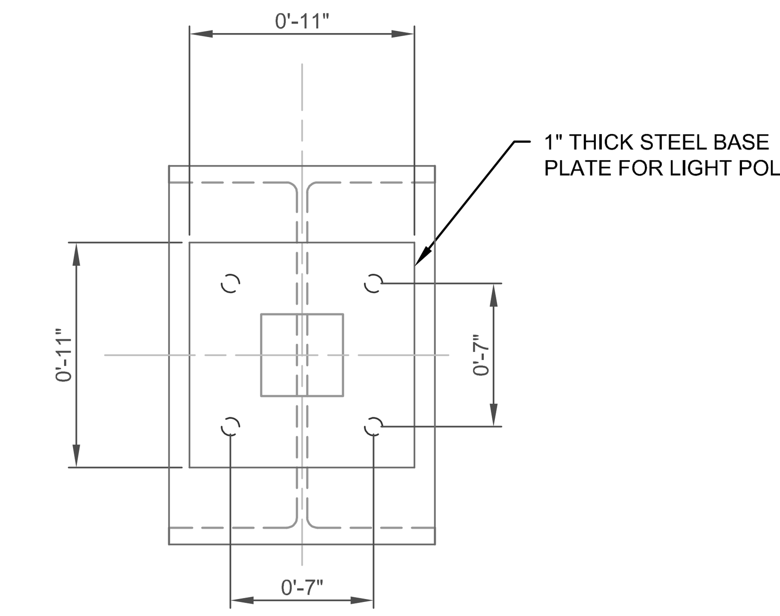
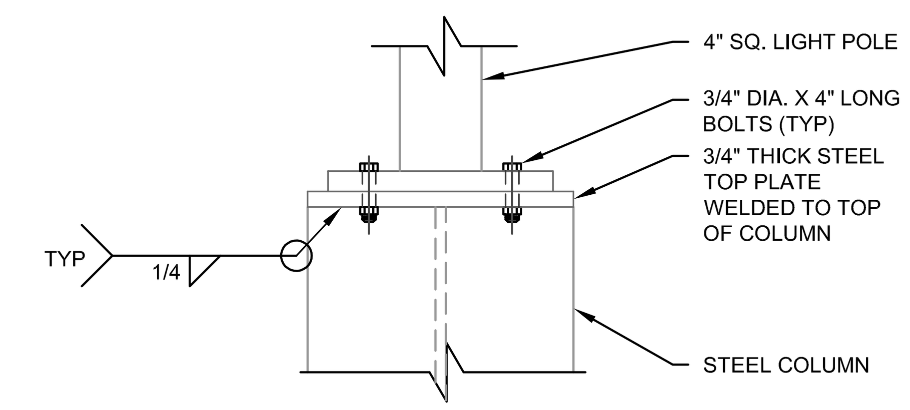
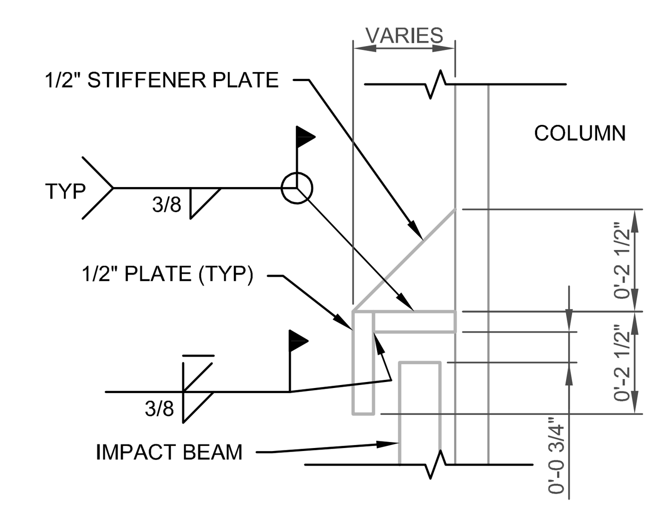


D4 DETAIL
SCALE: N.T.S.

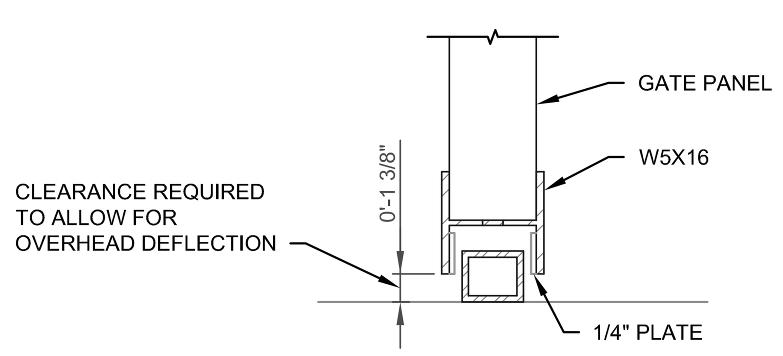




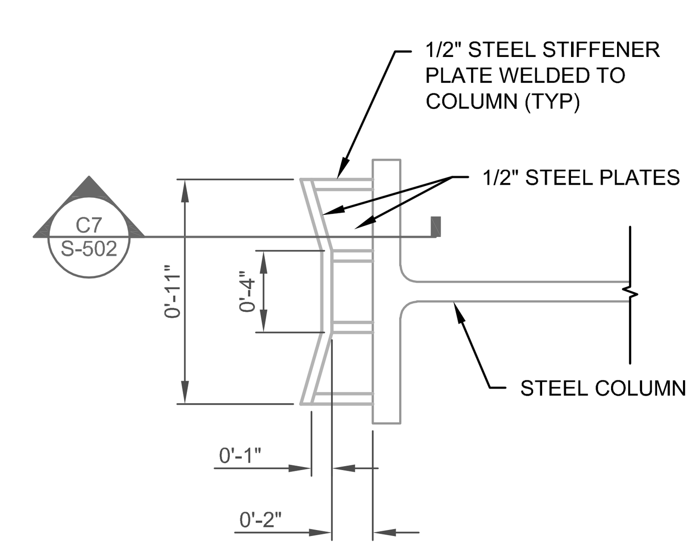
E7 DETAIL - LIGHT POLE CONNECTION
SCALE: N.T.S.



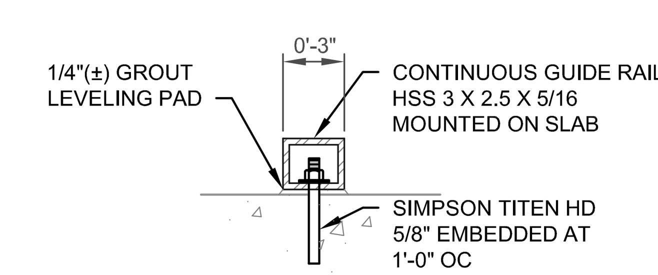
C7 IMPACT BEAM SECTION
SCALE: N.T.S.



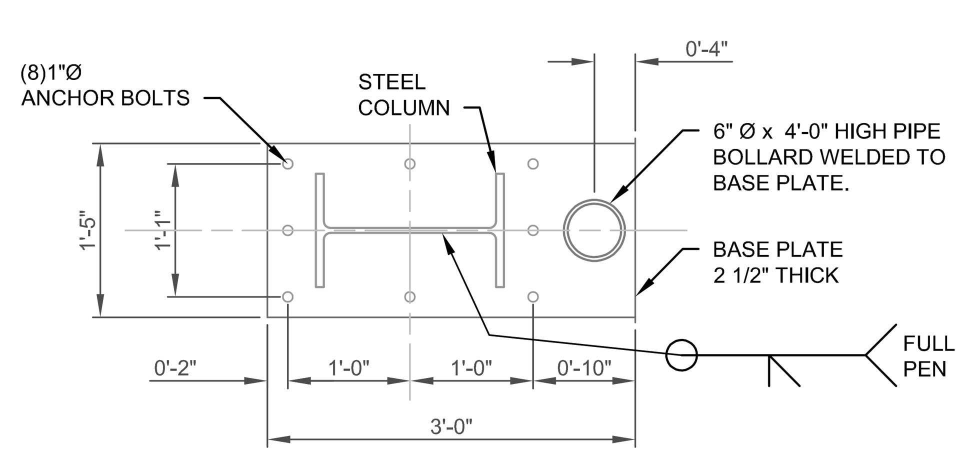
C1 BOTTOM RAIL GUIDE
SCALE: N.T.S.



B4 DETAIL - IMPACT BEAM BRACKETS
SCALE: N.T.S.



B7 BOTTOM RAIL DETAIL
SCALE: N.T.S.



A1 DETAIL - COLUMN BASE PLATE
SCALE: N.T.S.

GENERAL NOTES

SHEET NOTES

1. INSTALL DRAINAGE HOLES AT 1'-0" O.C. ON THE IMPACT BEAM.
2. BOLLARDS SHALL BE INSTALLED ONLY BY COLUMNS NEXT TO THE ROAD.
3. SEAL INSTALLATION HOLES ON THE GUIDE RAIL.

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MARK	DESCRIPTION	DATE

ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

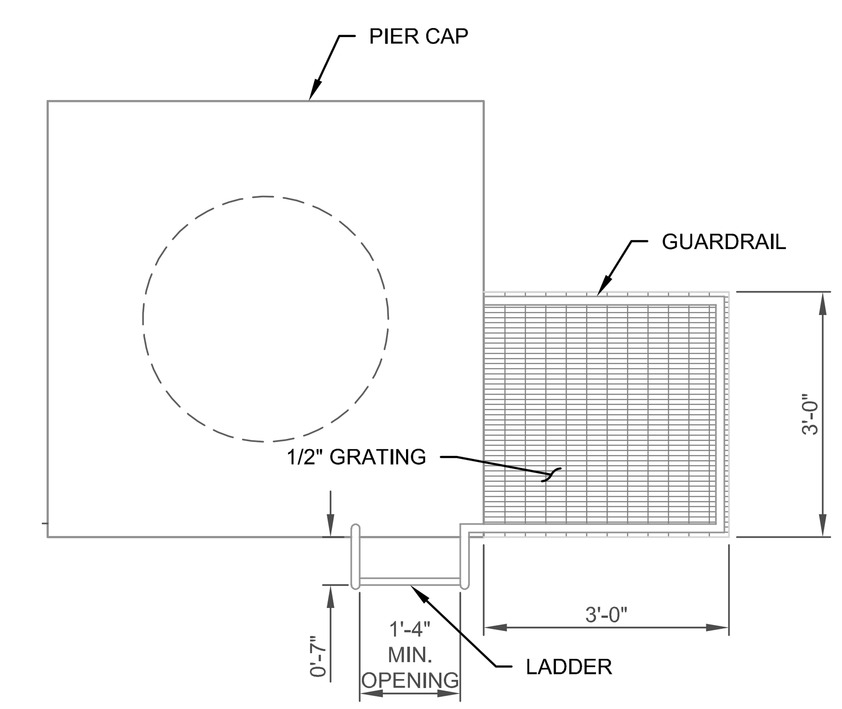
DESIGNED BY: X
DRAWN BY: X
CHECKED BY: X
SUBMITTED BY: X
SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

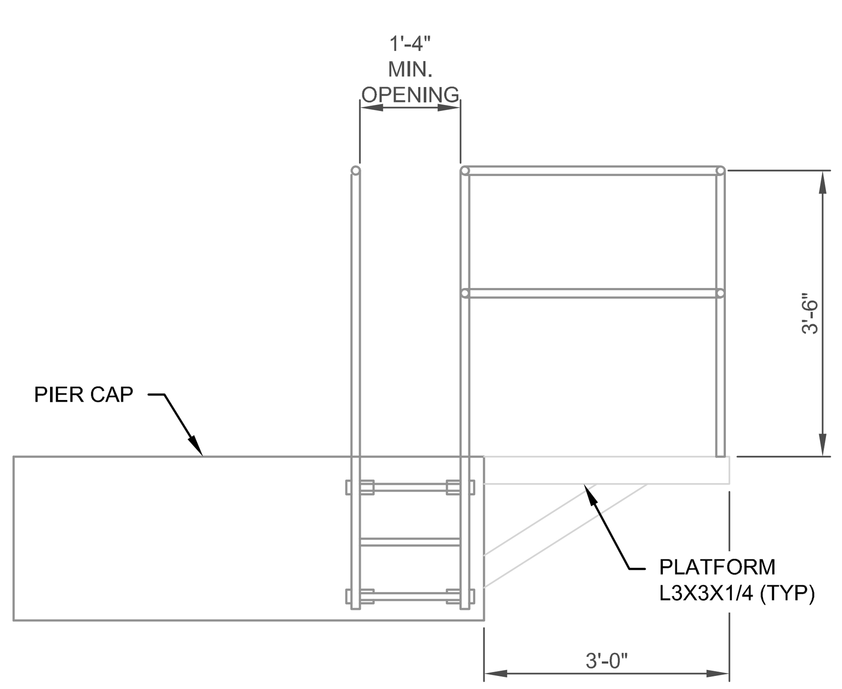
ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE
STRUCTURAL DETAILS

SHEET ID
ROMA
S-502



E1 OPERATOR PLATFORM - PLAN
SCALE: N.T.S.



C1 OPERATOR PLATFORM - ELEVATION
SCALE: N.T.S.

GENERAL NOTES

SHEET NOTES

1. ACCESS LADDER NOT REQUIRED ON THE SITE IF DIFFERENCE BETWEEN TOP OF PIER CAP AND GRADE IS 1'-0" OR LESS.
2. CONTRACTOR TO DESIGN OPERATOR PLATFORM WHERE REQUIRED.

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MARK | DESCRIPTION | DATE

ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:
DESIGNED BY: X
DRAWN BY: X
CHECKED BY: X
SUBMITTED BY: X
SIZE: ANSI D

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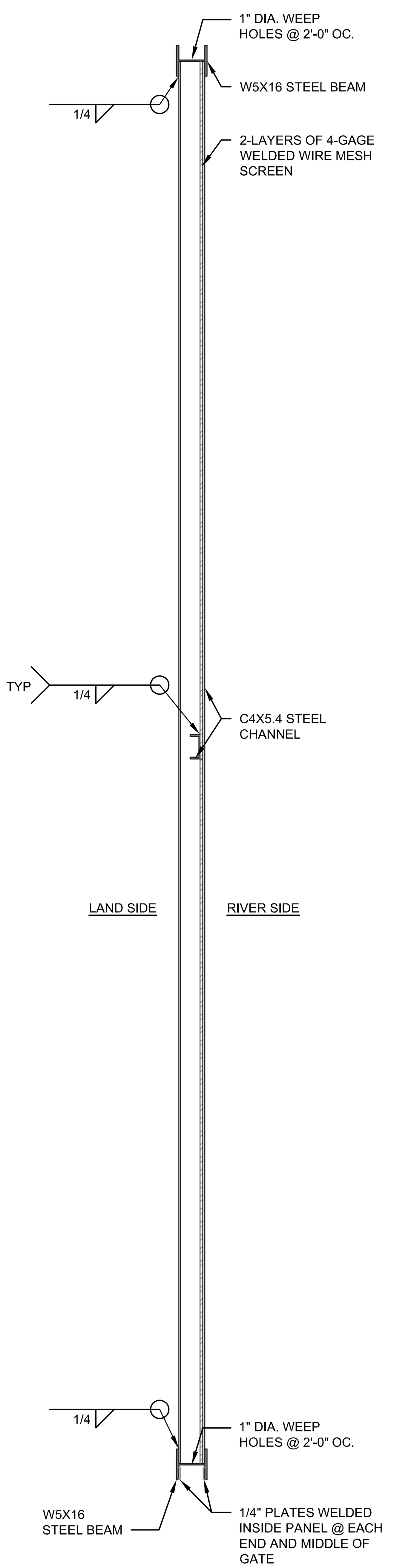
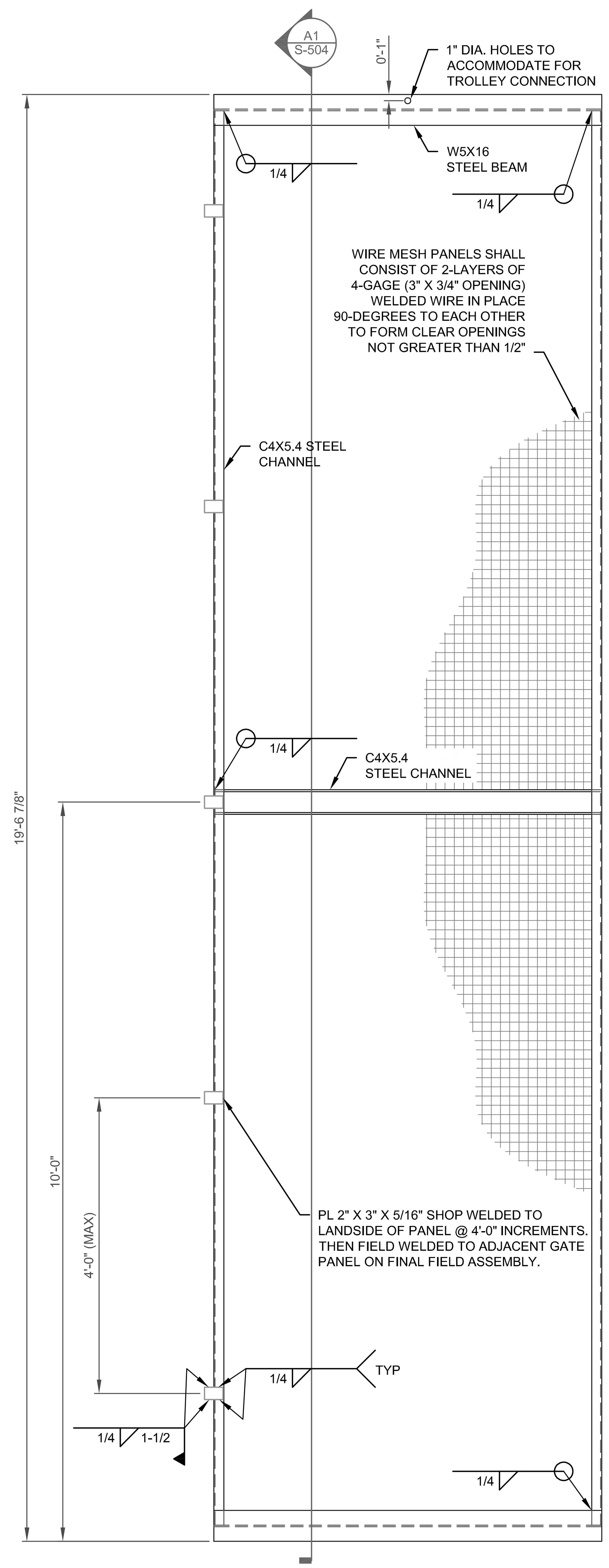
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

STRUCTURAL DETAILS

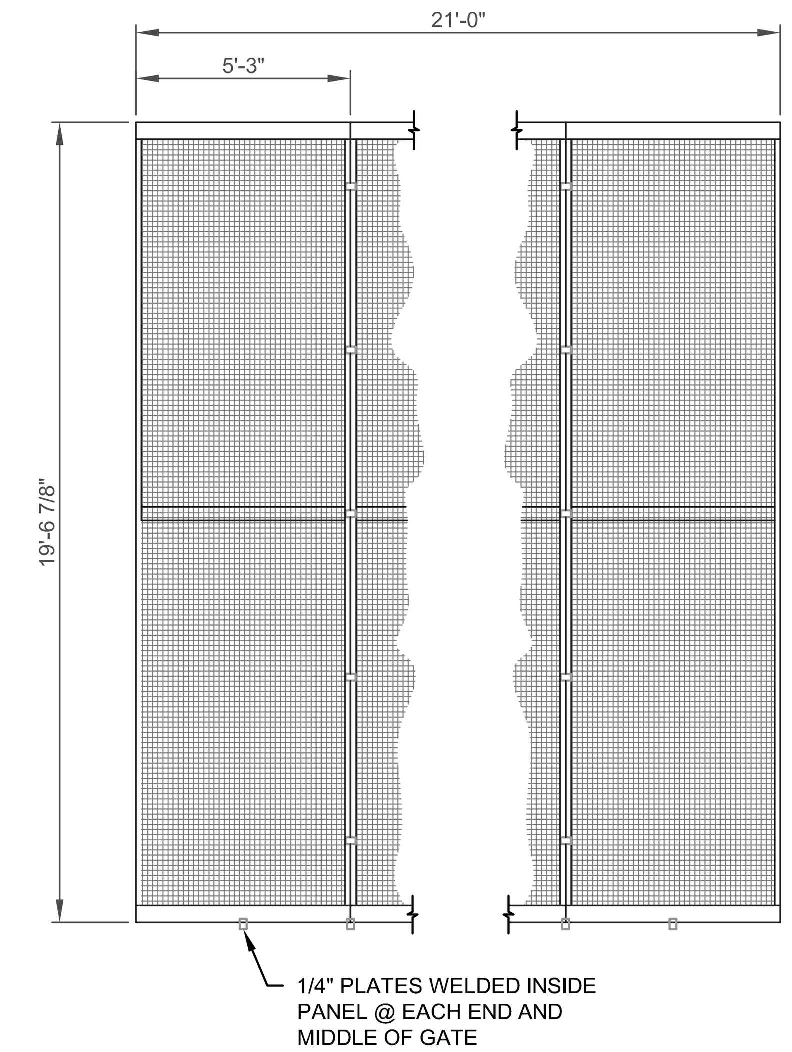
SHEET ID
ROMA
S-503



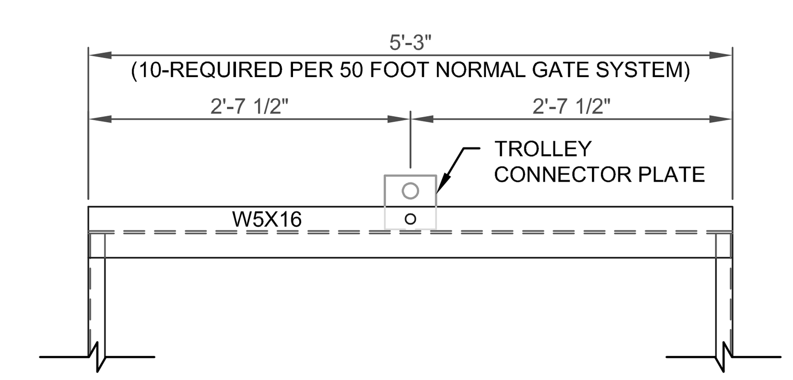
A1 SECTION
SCALE: N.T.S.



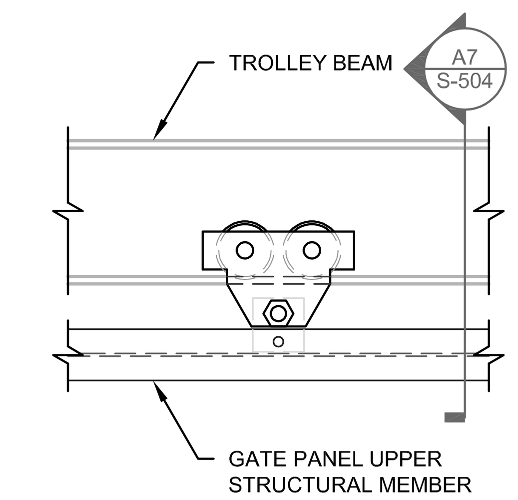
A3 ELEVATION
SCALE: N.T.S.



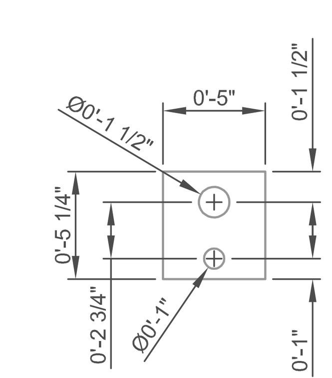
E5 ELEVATION - WIRE MESH GATES (TYP.)
SCALE: N.T.S.



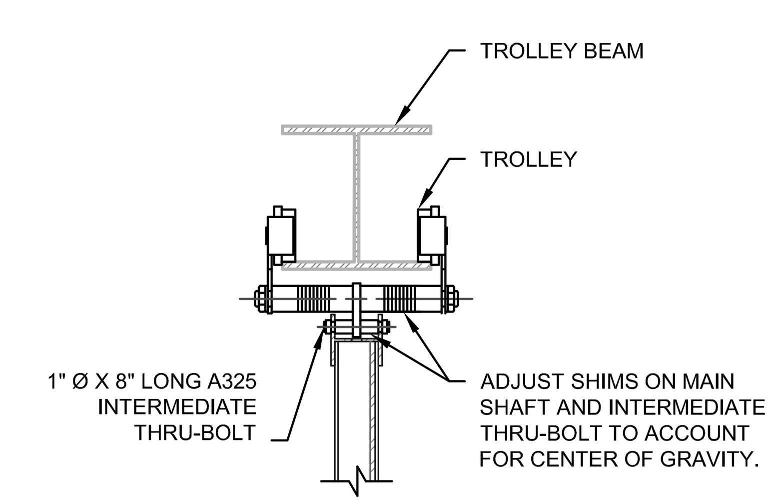
C5 DETAIL - TROLLEY CONNECTOR PLATE
SCALE: N.T.S.



C7 DETAIL - TROLLY CONNECTION
SCALE: N.T.S



A5 DETAIL - TROLLEY CONNECTOR PLATES
SCALE: N.T.S.



A7 SECTION THROUGH TROLLEY
SCALE: N.T.S.

GENERAL NOTES

SHEET NOTES

1. JOIN COMPLETED PANELS TOGETHER IN FIELD USING WELD PLATES AND STITCH WELDS AS SHOWN.
2. AFTER GATE PANELS ARE ASSEMBLED, ATTACH OPERATOR GUIDE RAIL, IMPACT BEAM, AND OTHER APPURTENANCES IN THEIR APPROPRIATE POSITIONS FOR OPERATION.
3. REFER TO ELECTRIC AND CONTROL SCHEMATICS, FOR ATTACHMENT OF OTHER CONTROLS.
4. THE MESH SHALL BE POSITIONED SUCH THAT ONLY 3/4" ON CENTER VERTICAL BARS ARE PLACED ON THE RIVER SIDE.
5. STEEL FASTENERS SHALL CONFORM TO ASTM F3125 AND ASTM A325, AND SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION.
6. THE CONNECTOR PLATE DETAILED ON DETAIL A5 SHALL BE FABRICATED AND USED IN LIEU OF THE TROLLEY MANUFACTURER'S CONNECTOR PLATE.
7. CONNECTOR PLATE SHALL BE BOLTED TO THE UPPER FRAMING MEMBER OF THE PANELS.
8. WELDING SCHEME FOR DOUBLE LAYER 4-GAGE WIRE MESH:
   - VERTICAL COMPONENT OF WIRE MESH SHALL BE POSITIONED FACING RIVER SIDE.
   - WIRE MESH LAYERS SHALL BE SPOT-WELDED TO EACH OTHER ON APPROXIMATE 12" CENTERS, OR AS REQUIRED TO PREVENT WARPING.
   - WIRE MESH LAYERS SHALL BE WELDED TOGETHER AND AT THE GATE PANEL PERIMETER ON APPROXIMATE 12" CENTERS, OR AS REQUIRED TO PREVENT WARPING.
   - WIRE MESH SHALL ALSO BE WELDED TO C4X5.4 CROSS-FRAMING AT 12" CENTERS TOP AND BOTTOM OF CHANNEL.
9. INSTALL ONE TROLLEY PER PANEL.

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MARK	DESCRIPTION	DATE

ISSUED DATE:
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

DESIGNED BY: X
DRAWN BY: X
CHECKED BY: X
SUBMITTED BY: X
SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
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2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
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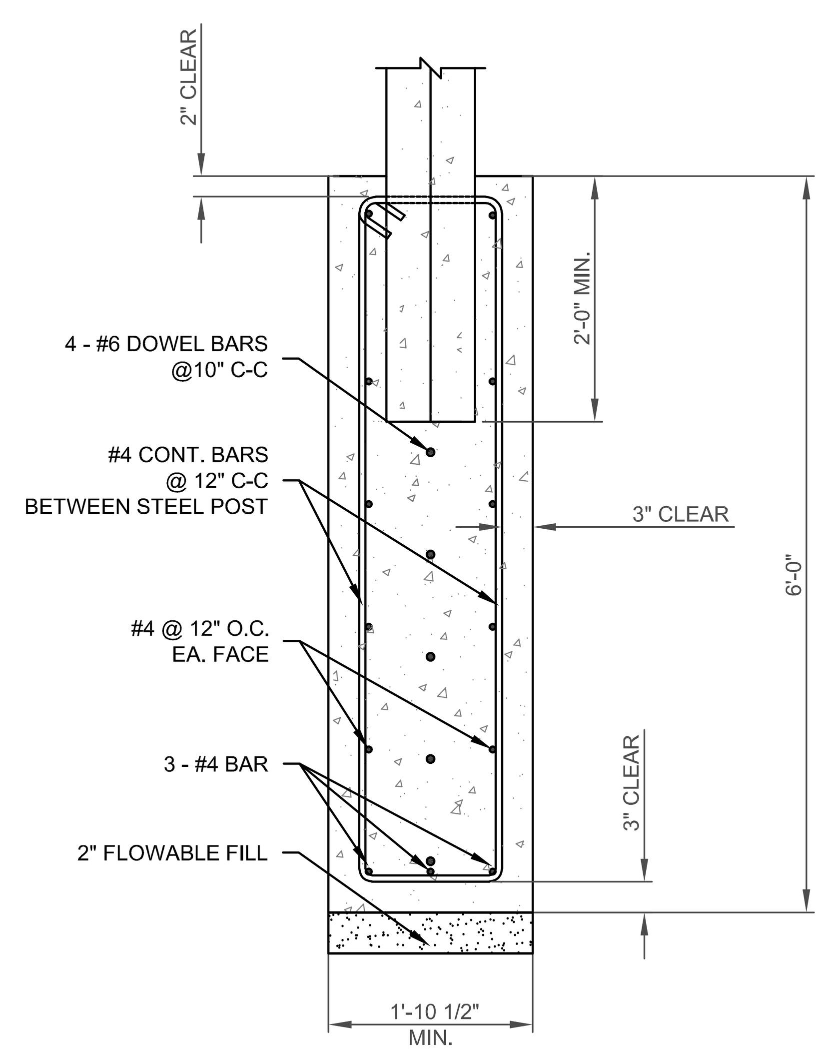
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

WIRE MESH PANEL DETAILS

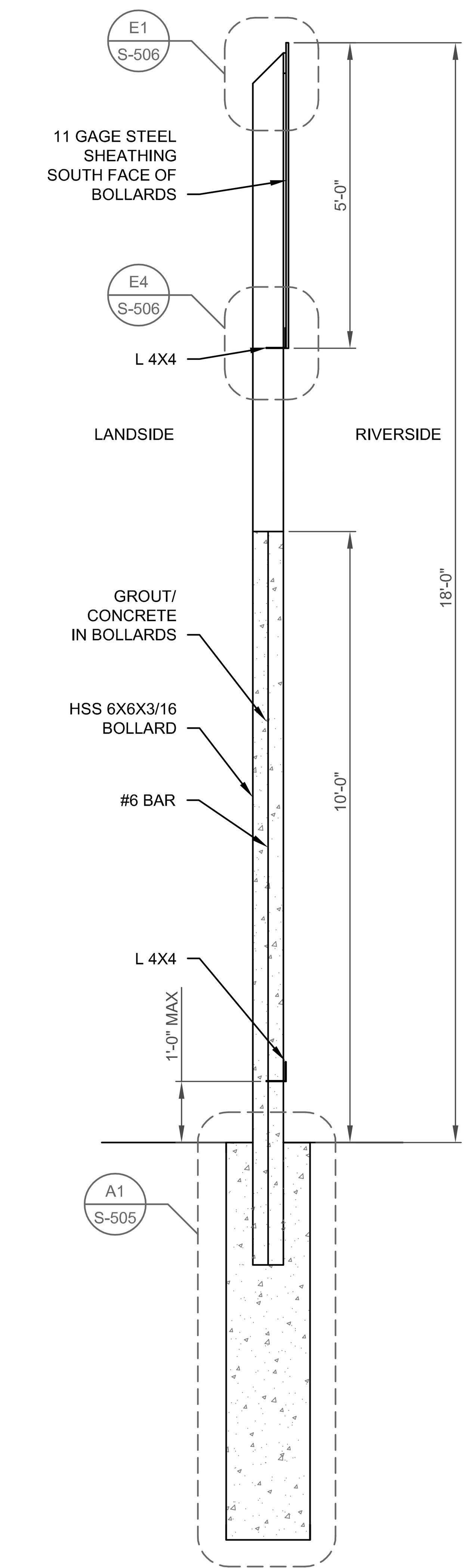
SHEET ID
ROMA
S-504

GENERAL NOTES

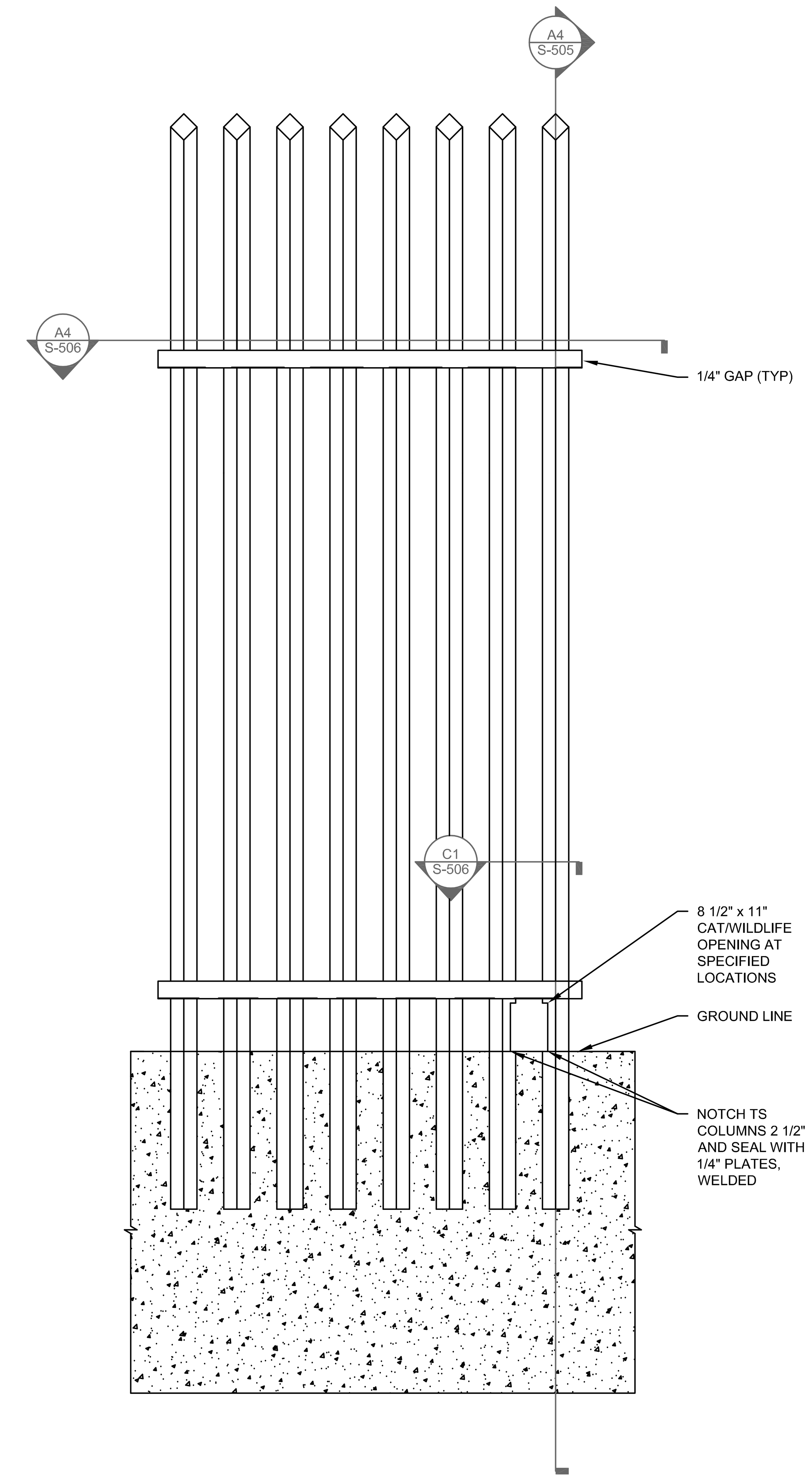
1. 6" MIN. CLR. REQUIRED BETWEEN BOTTOM OF HSS & BOTTOM OF FOUNDATION.
2. CONCRETE TO BE 4000 PSI.
3. STEEL BOLLARDS SHALL BE ASTM A500 GRADE B. REFERENCE TECHNICAL SPECIFICATIONS FOR ALL OTHER MATERIAL REQUIREMENTS NOT PROVIDED IN THE DRAWINGS.
4. PLACE A 2" (MIN) FLOWABLE FILL MUD-MAT AFTER EXCAVATION FOR THE BOLLARD FENCE FOUNDATION. MUD MAT TO ACT AS A LEVELING PAD FOR THE FOUNDATION.
5. AT LOCATIONS DIRECTED BY CBP, NOTCH TWO ADJACENT BOLLARDS 2 $\frac{1}{2}$" TO HEIGHT REQUIRED TO PROVIDE 8 $\frac{1}{2}$" x 11" CAT OPENING.
6. BOLLARD FILLER FENCE WILL BE SUPPORTED ON A 6-FOOT-DEEP FOUNDATION. THE FINAL REPORT WILL PROVIDE FOOTING BEARING AND SUBGRADE PREPARATION CRITERIA FOR SUPPORT ON STIFF, LEAN AND FAT, CLAYEY NATIVE SOILS, WHICH WILL LIKELY INCLUDE 1) AN ALLOWABLE BEARING PRESSURE OF 2,000 PSF; 2) CLEANING OF LOOSENED OR SLOUGHED SOILS PRIOR TO CONCRETE PLACEMENT; 3) REVIEW OF PREPARED BEARING SURFACES PRIOR TO REINFORCING STEEL AND CONCRETE PLACEMENT; AND 4) PLACEMENT OF A MINIMUM 2" THICK CONCRETE MUD MAT IMMEDIATELY FOLLOWING BEARING SURFACE REVIEW AND PRIOR TO REINFORCING STEEL PLACEMENT IN ORDER TO LIMIT ANY CHANGES IN THE IN-SITU SUBGRADE MOISTURE CONTENT.



A1 BOLLARD FENCE FOUNDATION
SCALE: N.T.S.



A4 BOLLARD FENCE SECTION
SCALE: N.T.S.



A7 TYPICAL 8' SECTION BOLLARD FENCE
SCALE: N.T.S.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

ISSUED DATE:
SOLICITATION NO:
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FILE NUMBER:

DESIGNED BY: B.PRESTON
DRAWN BY: B.DUNNE
CHECKED BY: B.PRESTON
SUBMITTED BY: B.PRESTON
SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
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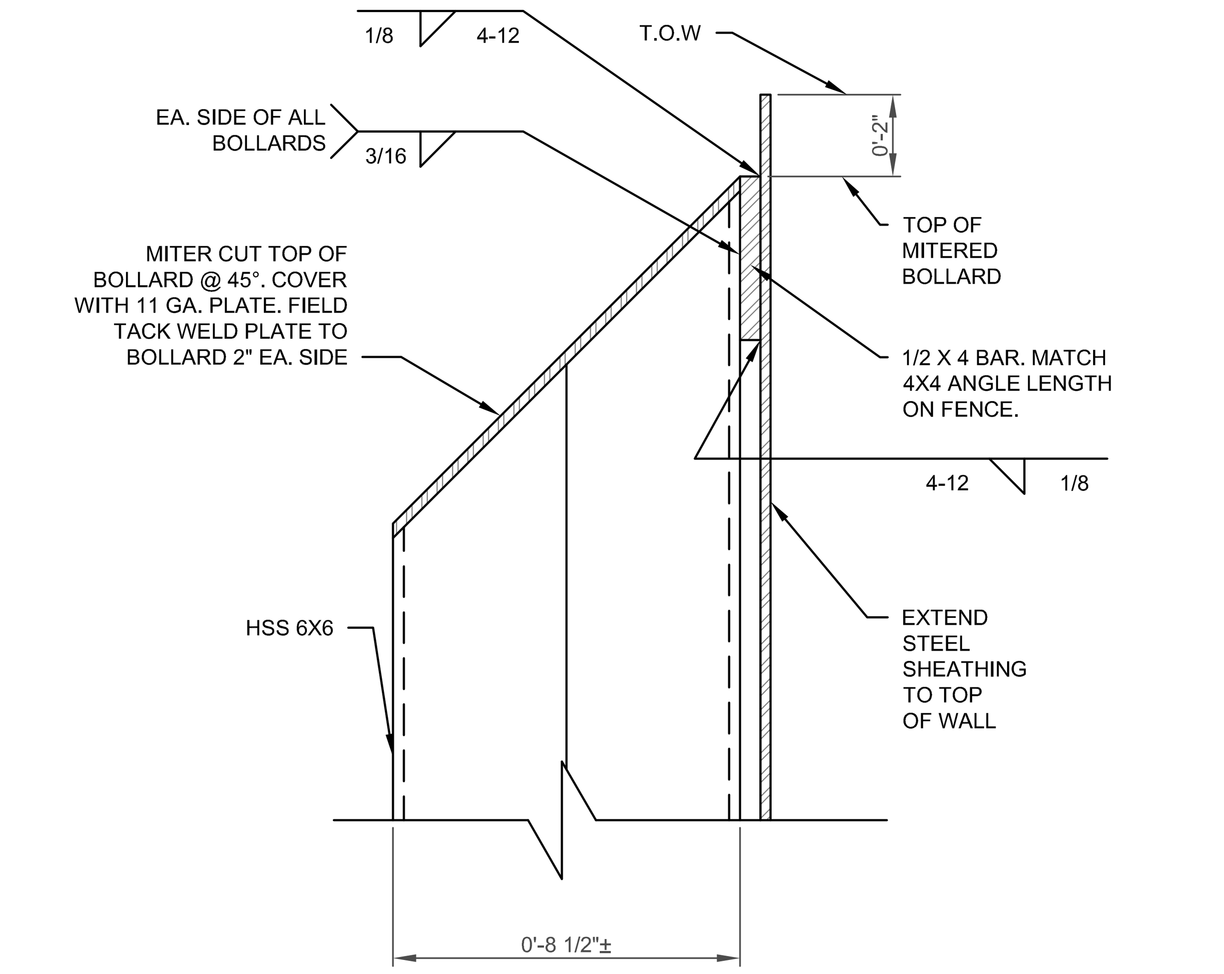
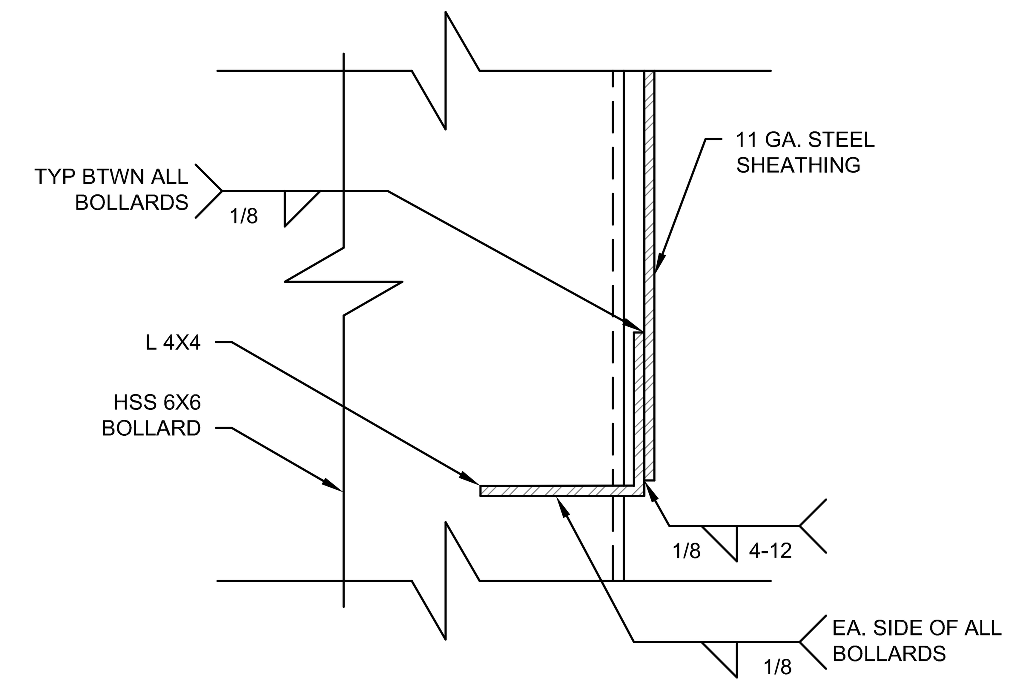
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

FENCE DETAILS

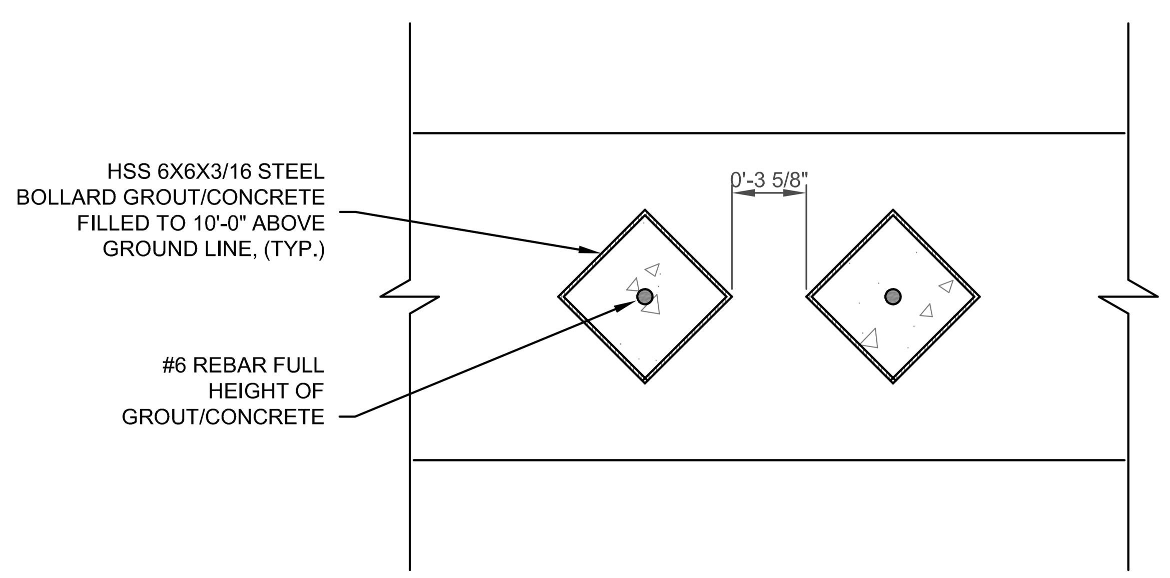
SHEET ID
ROMA
S-505



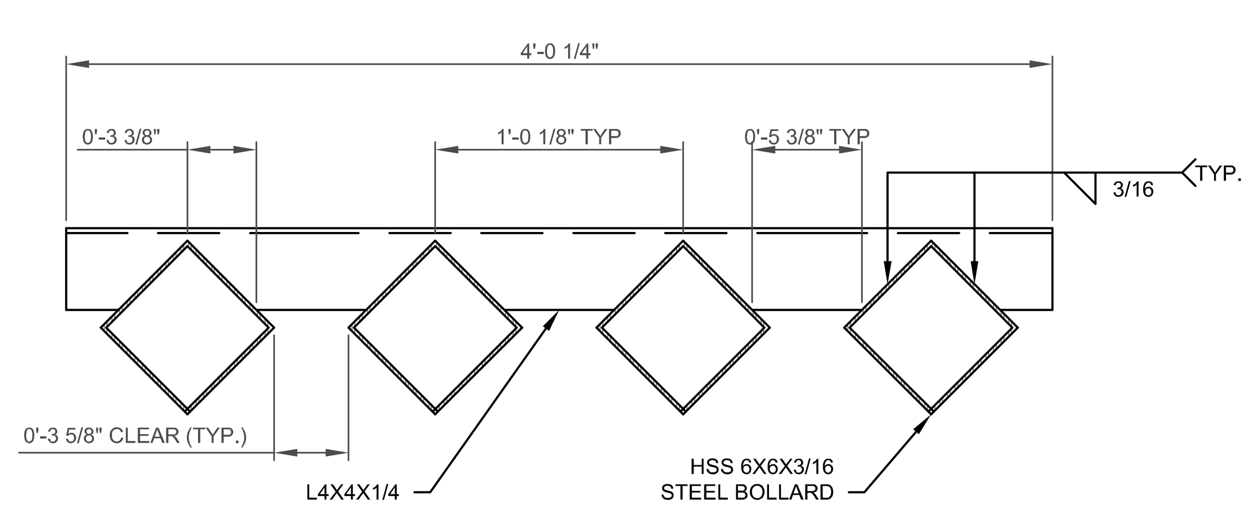
E1 TOP OF FENCE DETAIL
SCALE: N.T.S.



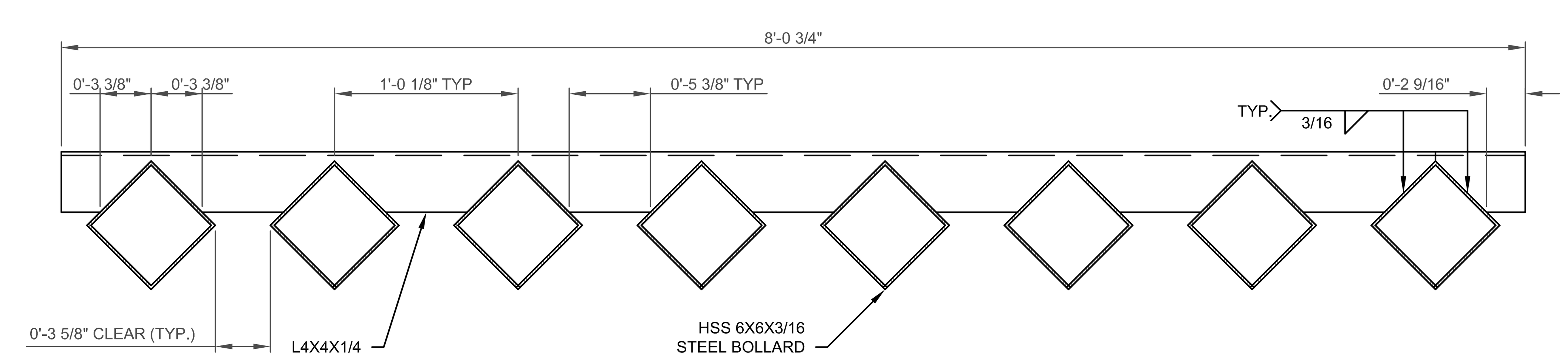
E4 BOTTOM OF SHEATHING DETAIL
SCALE: N.T.S.



C1 BOLLARD FENCE DETAIL
SCALE: N.T.S.



A1 BOLLARD FILLER FENCE
SCALE: N.T.S.



A4 BOLLARD FENCE
SCALE: N.T.S.

GENERAL NOTES

1. 6" MIN. CLR. REQUIRED BETWEEN BOTTOM OF HSS & BOTTOM OF FOUNDATION.
2. CONCRETE TO BE 4000 PSI.
3. STEEL BOLLARDS SHALL BE ASTM A500 GRADE B. REFERENCE TECHNICAL SPECIFICATIONS FOR ALL OTHER MATERIAL REQUIREMENTS NOT PROVIDED IN THE DRAWINGS.

XX

US Army Corps of Engineers ®

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DESIGNED BY: B.PRESTON
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US ARMY CORPS OF ENGINEERS
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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

FENCE DETAILS

SHEET ID
ROMA
S-506

ONE-LINE AND RISER

- KVA,CLG / HV-LV / Z — POWER TRANSFORMER
- AMP / * — LOW VOLTAGE CIRCUIT BREAKER, DRAWOUT:
  - E.O. = ELECTRICALLY OPERATED
  - G = GROUND
  - I = INSTANTANEOUS
  - IA = INSTANTANEOUS AMPS
  - LT = LONG TIME
  - M.O. = MANUALLY OPERATED
  - ST = SHORT TIME
  - S = SENSOR RATING
- A — MOLDED CASE CIRCUIT BREAKER
- AF — MEDIUM VOLTAGE CIRCUIT BREAKER, DRAWOUT
- MINIATURE CIRCUIT BREAKER
- AMP / FUSE — FUSED CUT-OUT SWITCH
- AMP / AMP — FUSED DISCONNECT SWITCH
- AMP — NON-FUSED DISCONNECT SWITCH
- AF / AT / SIZE / * — COMBINATION CIRCUIT BREAKER WITH STARTER:
  - FVNR = FULL VOLTAGE NON-REVERSING
  - FVR = FULL VOLTAGE REVERSING
  - 2S = TWO SPEED
  - 1W = ONE WINDING
  - 2W = TWO WINDING
  - C = CONTACTOR
  - SFT = SOFT START
- AMP / FUSE — MEDIUM VOLTAGE MOTOR STARTER
- PANELBOARD
- TRANSFER SWITCH (AUTOMATIC OR MANUAL)
- CONVERTER OR VFD
  - * = { ~ = AC, - = DC
- HP — MOTOR
- GEN / KW / KVA / PF / Z — GENERATOR
- * — LOCAL CONTROL:
  - CP = CONTROL PANEL
  - HTR = HEATER
  - SKD = SKID MOUNTED LOAD
  - VFD = VARIABLE FREQUENCY DRIVE
  - HOA = HAND/OFF/AUTO
- KV / MCOV — SURGE ARRESTOR
- AMP — FUSE
- BATTERY
- OPEN DELTA
- IMPEDANCE GROUNDED WYE
- GROUND
- DELTA
- SOLID GROUNDED WYE
- * — MULTIFUNCTION RELAY OR METER (* NOTE 5)
- (QTY) PRI:SEC ACCUR — VOLTAGE TRANSFORMER
- (QTY) PRI/SEC ACCUR — CURRENT TRANSFORMER
  - ■ INDICATES POLARITY
- PRI/SEC ACCUR — CURRENT TRANSFORMER, ZERO SEQUENCE
- WH — WATT HOUR METER

RACEWAY AND LINE TYPES

- CONDUIT STUB WITH CAP
- CONDUIT:
  - EMBEDDED
  - EXPOSED
  - UNDERGROUND DIRECT BURIAL
- C — CONDUIT TURN-DOWN
- O — CONDUIT TURN-UP
- J — JUNCTION BOX
- BUS
- POWER CIRCUIT
- CT & VT CIRCUIT
- CONTROL CIRCUIT
- COMMUNICATION
- ELECTRICAL ENCLOSURE
- E_X — EXISTING OVERHEAD ELECTRICAL LINES
- NEW UNDERGROUND COMMUNICATIONS DUCTBANK
- NEW UNDERGROUND ELECTRICAL DUCTBANK
- INDICATES CABLE NUMBER
- HOME RUN CONDUIT - SHORT STROKES INDICATE PHASE OR SWITCHED WIRES, LONG STROKES INDICATE NEUTRAL, LONG STROKES WITH DOT INDICATE GROUND CONDUCTORS, LONG STROKES WITH TICK INDICATE ISOLATED GROUND

PLAN VIEW

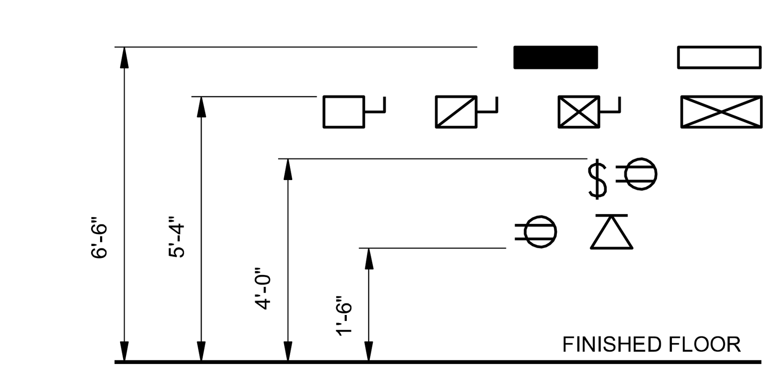
- T — TRANSFORMER
- NON-FUSED DISCONNECT SWITCH
- FUSED DISCONNECT SWITCH
- COMBINATION DISCONNECT WITH STARTER
- $ HP — HORSEPOWER RATED DISCONNECT SWITCH
- PANELBOARD, 480Y/277V OR 480V
- PANELBOARD, 208Y/120V OR 120/240V
- SERVICE ENTRANCE METER
- XFR — TRANSFER SWITCH (AUTOMATIC OR MANUAL)
- M — MOTOR
- GEN — GENERATOR
- LOCAL CONTROL PANEL
- SPECIAL PURPOSE RCPT OR CONNECTION, 480V
- SPECIAL PURPOSE RCPT OR CONNECTION, 240V
- MH — MANHOLE
- HH — HANDHOLE
- SINGLE RECEPTACLE
- DUPLEX RECEPTACLE
- FOURPLEX RECEPTACLE
- J — SURFACE RACEWAY (WIREMOLD)
- COIL

LIGHTING

(SEE NOTE 3)

- X — LED BOLLARD LIGHT
- X — HID/INCANDESCENT, WALL MOUNTED
- X — HID/INCANDESCENT, POLE MOUNTED
- EMERGENCY BATTERY OPERATED UNIT

ELECTRICAL DEVICE MOUNTING HEIGHT



LIGHTING CONTINUED

- EXIT SIGN, SINGLE FACE, CEILING MOUNT
- EXIT SIGN, DOUBLE FACE, CEILING MOUNT
- EXIT SIGN, ARROW INDICATES DIRECTION
- WALL MOUNT
- LIGHTING CONTROL:
  - LC = LIGHTING CONTACTOR
  - OC = OCCUPANCY SENSOR
  - PE = PHOTOELECTRIC CELL
  - TC = TIME CLOCK
  - C = CONTACTOR
  - PSR = PHOTO SENSOR - RECEIVER
  - PST = PHOTO SENSOR - TRANSMITTER
- $ — SWITCH, SINGLE POLE
- $ * — SWITCH:
  - 3 = THREE-WAY
  - 4 = FOUR-WAY
  - D = DIMMER
  - K = KEY OPERATED
  - P = PILOT
  - a,b,c = DENOTES SWITCHING CONTROL
- PS — SAFETY PHOTO SENSOR
- ML — MAGLOCK
- KP — SECURITY KEYPAD

COMMUNICATION

- TEL — TELEPHONE PANEL
- TTB — TELEPHONE TERMINAL BOARD
- AMP — AMPLIFIER
- CCTV SURVEILLANCE CAMERA, FIXED
- CCTV SURVEILLANCE CAMERA, PAN/ZOOM/TILT
- WALL MOUNT

GROUNDING

- GROUND CONDUCTOR
- LIGHTNING PROTECTION CONDUCTOR
- GROUND
- GROUND ROD
- LIGHTNING PROTECTION AIR TERMINAL
- LIGHTNING PROTECTION SPHERE
- THROUGH ROOF TERMINAL
- GROUNDING CONNECTION TO STRUCTURE
- FLUSH GROUND PLATE
- GROUND CONDUCTOR CONNECTION
- GROUNDING PIGTAIL

GENERAL NOTES

1. ALL SYMBOLS AND ABBREVIATIONS SHOWN ON THIS LEGEND MAY NOT APPEAR ON THIS SET OF DRAWINGS.
2. FOR GENERAL LEGEND AND ABBREVIATIONS, SEE "GG" DRAWINGS.
3. X ON FIXTURE SYMBOL DENOTES FIXTURE TYPE DESIGNATION. SEE FIXTURE SCHEDULE.
4. USE DIRECTIONAL ARROW ON EXIT SIGNS AS REQUIRED.
5. IEEE STANDARD C37.2-1991, ELECTRICAL POWER SYSTEM DEVICE FUNCTION NUMBERS.

ELECTRICAL ABBREVIATIONS

NOTE: NOT ALL ABBREVIATIONS INDICTED MAY APPEAR ON THESE DRAWINGS

ABOVE FINISH FLOOR	AFF
ABOVE FINISHED GRADE	AFG
ACCENT	ACC
ADJUSTABLE	ADJ
ALTERNATING CURRENT	AC
ALUMINUM	AL
AMERICAN WIRE GAUGE	AWG
AMMETER	AM
AMPERE	A/AMP
APPROXIMATE(LY)	APPROX
ASYMMETRIC	ASY
AUTOMATIC TRANSFER SWITCH	ATS
BATTERY	BATT
BLACK	BLK
BRACKET	BRKT
BREAKER	BKR
CABINET	CAB
CABLE TELEVISION	CATV
CEILING	CLG
CIRCUIT	CKT
CIRCUIT BREAKER	CKT BKR
CLEAR	CLR
CLOSED CIRCUIT TELEVISION	CCTV
COLUMN	COL
COMMUNICATION	COMM
CONDUIT	C
COOL WHITE	CW
COPPER	CU
CURRENT LIMITING FUSE	CLF
CURRENT TRANSFORMER	CT
DECIBEL	DB
DEDICATED	DED
DIAMETER	DIA
DIRECT CURRENT	DC
DISCONNECT	DISC
DISTRIBUTION PANEL	DP
DOUBLE POLE DOUBLE-THROW	DPDT
DOWNLIGHT	DNLT
DRAWING	DWG
DUAL ELEMENT	DE
EACH	EA
ELECTRIC WATER COOLER	EWC
ELECTRICAL	ELEC
ELECTRICAL CONTRACTOR	EC
ELECTRICALLY OPERATED	ED
ELEVATION	EL
ELEVATOR	ELEV
EMERGENCY LIGHTING	EM
ENERGY SAVING BALLAST	ESB
EQUIPMENT	EQUIP
EXHAUST FAN	EF
EXPLOSION PROOF	XP
FIRE ALARM	FA
FIRE ALARM ANNUNCIATOR PANEL	FAAP
FIRE ALARM CONTROL PANEL	FACP
FIRE ALARM GRAPHIC PANEL	FAGP
FIRE ANNUNCIATOR PANEL	ANNUN
FIXTURE	FIXT
FLOOR	FL
FLUORESCENT	FLUOR
FOOTCANDLES	FC
FULL LOAD AMPERES	FLA
FULL VOLTAGE NON-REVERSING	FVNR
GENERAL CONTRACTOR	GC
GENERATOR	GEN
GROUND	GND/G
GROUND FAULT CIRCUIT INTERRUPTER	GFCI
HAND DRYER	HD
HAND HOLE	HH
HEATING VENTILATING AND AIR CONDITIONING	HVAC
HERTZ	HZ
HIGH INTENSITY DISCHARGE	HID
HIGH POWER FACTOR	HPF
HIGH VOLTAGE	HV
HORSEPOWER	HP
INCANDESCENT	INCAN
ISOLATED GROUND	IG
JUNCTION BOX	JB OR JCT BOX
KILOVAR (REACTANCE)	KVAR
KILOVOLT AMPERE	KVA
KILOWATT	KW
KILOWATT HOUR METER	KWH
LIGHT	LT
LIGHTING	LTG
LIGHTING ARRESTOR	LA
LOW VOLTAGE	LV
MAIN CIRCUIT BREAKER	MCB
MAIN DISTRIBUTION PANEL	MDP
MAIN LUGS ONLY	MLO
MANHOLE	MH
MANUAL TRANSFER SWITCH	MTS
MANUFACTURER	MFR
MASTER ANTENNA TELEVISION	MATV
MECHANICAL CONTRACTOR	MC
MEDIUM VOLTAGE	MV
METAL HALIDE	MH
METAL-CLAD CABLE	MC
MISCELLANEOUS	MISC
MOTOR CIRCUIT PROTECTOR	MCP
MOTOR CONTROL CENTER	MCC
MOTOR OPERATED DAMPER	MOD
MOUNTED	MTD
MOUNTING HEIGHT	MTG HT
NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION	NEMA
NATIONAL ELECTRICAL CODE	NEC
NIGHT LIGHT	NL
NORMALLY CLOSED	NC
NORMALLY OPEN	NO
NOT AVAILABLE/NOT APPLICABLE	N/A
NOT FUSED	NF
NOT IN CONTRACT	NIC
NOT TO SCALE	NTS
ON CENTER	OC
OVERHEAD	OH
OVERLOAD HEATER ELEMENT	OL
PANEL	PNL
PEWTER	PEW
PLYWOOD	PLY
POLE	P
POLYVINYL CHLORIDE	PVC
POTENTIAL TRANSFORMER	PT
POWER PANEL	PP
PULL BOX	PB
RAPID START	RS
RECEPTACLE	REC/RECPT
REFLECTOR	REFL
REQUIRED	REQ'D
RIGID GALVANIZED STEEL CONDUIT	RGS
ROOM	RM
SCHEDULE	SCHED
SINGLE POLE DOUBLE THROW	SPDT
SINGLE POLE SINGLE THROW	SPST
SOLID STATE BALLAST	SSB
SURGE PROTECTION DEVICE	SPD
SWITCH	SW
SWITCHBOARD	SWBD
SWITCHGEAR	SWGR
TELEPHONE	TEL
TRANSFORMER	XFMR
TRANSIENT VOLTAGE SURGE SUPPRESSOR	TVSS
TWIN TUBE	TT
TYPICAL	TYP
UNDERGROUND	UG
UNDERWRITERS' LABORATORIES	UL
UNINTERRUPTIBLE POWER SUPPLY	UPS
UNLESS OTHERWISE NOTED	UON
VAPOR PROOF	VP
VOLT	V
VOLTMETER	VM
WARM WHITE	WW
WATT	W
WEATHERPROOF	WP
WITH	W/
WITHIN	W/I
WITHOUT	W/O

US Army Corps of Engineers ®

DATE | DESCRIPTION | MARK

ISSUED DATE: | SOLICITATION NO: | CONTRACT NO.: | FILE NUMBER:

DESIGNED BY: M.J. HILL | DRAWN BY: D.A. NELSON | CHECKED BY: | SUBMITTED BY: | SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BARRIER FENCE

LEGEND AND ABBREVIATIONS

SHEET ID
ROMA
E-001

LIGHTING GENERAL NOTES

1. THESE PLANS ARE INTENDED TO DEPICT THE LIGHT FIXTURE POLE LAYOUT, CIRCUITING REQUIREMENTS, PHOTOMETRIC REQUIREMENTS, AND OTHER GENERAL REQUIREMENTS FOR THE LIGHT FIXTURES TO BE USED.
2. THE INTENT OF THE LIGHTING DESIGN IS A PERFORMANCE SPECIFICATION, DESIGNED TO GIVE SPECIFIC REQUIREMENTS FOR THE PERFORMANCE OF THE LIGHT FIXTURES. REFERENCE SPECIFICATIONS FOR ALL REQUIREMENTS. ANY MANUFACTURER MEETING ALL REQUIREMENTS WILL BE CONSIDERED ACCEPTABLE.
3. THE LIGHT FIXTURES FOR GENERAL ENFORCEMENT ZONE ILLUMINATION MUST MEET THE FOLLOWING PHOTOMETRIC REQUIREMENTS WITHIN THE ENFORCEMENT ZONE, AT THE LIGHT POLE HEIGHTS AND SPACING INDICATED ON THE PLANS (IN ADDITION TO OTHER REQUIREMENTS ON THE PLANS AND SPECIFICATIONS):
   - AVERAGE OF 3 HORIZONTAL FOOTCANDLES AT GRADE ACROSS THE ENTIRE ENFORCEMENT ZONE BOUNDARY INDICATED ON THE PLANS, WHICH RANGES FROM 50-150 FEET FROM THE BORDER FENCE AS SHOWN ON THE PLANS.
   - -MAXIMUM TO MINIMUM FOOTCANDLE RATIO OF 20 TO 1 WITHIN THE ENFORCEMENT ZONE.
   - -LIGHT TRESPASS BEYOND THE ENFORCEMENT ZONE SHALL BE LIMITED TO 0.5 FOOTCANDLES, AND SHALL TAPER TO BELOW 0.1 FOOTCANDLES AT A MAXIMUM OF 75 FEET BEYOND THE ENFORCEMENT ZONE BOUNDARY.
4. THE LIGHT FIXTURES AT THE VEHICULAR GATES MUST MEET THE FOLLOWING PHOTOMETRIC REQUIREMENTS WITHIN THE GATE AREAS, AT THE MOUNTING HEIGHT AND LOCATIONS INDICATED ON THE PLANS (IN ADDITION TO OTHER REQUIREMENTS ON THE PLANS AND SPECIFICATIONS):
   - ILLUMINATE A PERIMETER OF 100 FEET BY 100 FEET, CENTERED ON THE MIDDLE OF THE GATE TO A MINIMUM OF 2 FOOT CANDLES AT THE GROUND LEVEL.

MEDIA CONVERTER GENERAL NOTES

1. MEDIA CONVERTER SHALL BE CAPABLE OF (2) INDEPENDENT FIBER OPTIC INPUTS AND (1) PoE COPPER CABLING OUTPUT. MEDIA CONVERTER SHALL AUTOMATICALLY TRANSFER BETWEEN FIBER OPTIC INPUTS AS AVAILABLE.
2. MEDIA CONVERTERS SHALL BE POWERED UTILIZING STANDARD 110V ELECTRICAL OUTLET.

GROUNDING GENERAL NOTES

1. FENCE GROUNDING, WHERE INDICATED ON THE PLANS, SHALL CONSIST OF 3/4" X 10' GROUND ROD PER SPECIFICATIONS, WITH THE TOP OF GROUND ROD A DRIVEN A MINIMUM OF 6" BELOW THE TOP OF FINISHED GRADE. CONNECT AND BOND #6 CONDUCTOR FROM GROUND ROD TO FENCE BOLLARD AT LOCATIONS INDICATED ON PLANS. ENSURE THAT BOLLARD FENCING IS ELECTRICALLY CONTINUOUS THROUGH EITHER WELDED PLATE OR CONCRETE ENCASED REINFORCING STEEL.
2. ALL GROUNDING SHALL BE IN STRICT COMPLIANCE WITH ARTICLE 250 OF THE 2017 NATIONAL ELECTRICAL CODE.

TRANSFER SWITCH GENERAL NOTES

1. MANUAL TRANSFER SWITCHES LOCATED AT THE VEHICLE GATES AND UTILITY CONNECTION POWER DISTRIBUTION POINTS SHALL INCLUDE CAM-LOCK STYLE CONNECTORS FOR QUICK CONNECTION OF PORTABLE GENERATORS.

CAMERA INFRASTRUCTURE NOTES

1. THE INTENT OF THIS PROJECT IS TO INCLUDE THE NECESSARY INFRASTRUCTURE FOR FUTURE SECURITY CAMERA CONNECTIONS AT LIGHT POLES ALONG THE ENFORCEMENT ZONE BOUNDARY. CAMERAS, CAMERA MOUNTS, AND COPPER CABLING TO THE POLE MOUNTED CAMERAS FROM THE CAMERA BOXES AT THE BASE OF THE LIGHT POLES WILL BE PROVIDED AND INSTALLED BY OTHERS AS PART OF A FUTURE PROJECT. THIS PROJECT INCLUDES ONLY THE CONDUIT INFRASTRUCTURE TO THE LIGHT POLES, THE CAMERA BOXES AS DETAILED AT EVERY 6TH LIGHT POLE, AND THE MEDIA CONVERTERS WITHIN THE CAMERA BOXES.

MINI-POWER CENTER GENERAL NOTES

1. EACH MINI-POWER CENTER AS INDICATED ON THESE PLANS SHALL BE ENCLOSED IN A WEATHERPROOF NEMA 4X ENCLOSURE, AND SHALL STEP THE VOLTAGE DOWN FROM 480V TO 120/240V, SINGLE PHASE. EACH MINI-POWER CENTER SHALL HAVE A MINIMUM INTEGRATED 3KVA TRANSFORMER WITHIN THE ENCLOSURE, AS WELL AS TRANSFORMER PRIMARY CIRCUIT BREAKER AND (8) 20A/1P SECONDARY CIRCUIT BREAKERS, FOR 120V FEEDERS TO CAMERA MEDIA CONVERTER ENCLOSURES.

GATE GENERAL NOTES

1. PROVIDE COMMUNICATIONS AND ELECTRICAL HANDHOLE AT EACH GATE.
2. PROVIDE COMMUNICATIONS, POWER, AND CONTROLS AT EACH GATE PER DRAWINGS E-503 AND E-603

ELECTRICAL GENERAL NOTES

1. THESE PLANS ARE SCHEMATIC. THE CONTRACT DOCUMENTS CREATED BY THIS OFFICE ARE DIAGRAMMATIC AND SHOW THE INTENTION OF THIS PROJECT TO INSTALL NEW EQUIPMENT AND ASSOCIATED MATERIALS. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS PRIOR TO BID.
2. ALL ELECTRICAL WORK IS REQUIRED TO BE PERFORMED BY A CERTIFIED ELECTRICAL CONTRACTOR. ALL WIRING, EQUIPMENT, DEVICES AND INSTALLATIONS SHALL CONFORM TO ALL APPLICABLE LOCAL, STATE AND FEDERAL CODES.
3. PROVIDE ALL WIRING, CONDUIT, LABOR AND MATERIALS NOT SHOWN ON PLAN, BUT NECESSARY FOR COMPLETE AND PROPER OPERATION OF THE ELECTRICAL SYSTEM.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL FEES AND PERMITS AS NECESSARY TO COMPLETE THIS JOB. CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS AND EQUIPMENT NECESSARY TO ENSURE A COMPLETE WORKING SYSTEM.
5. ALL ELECTRICAL WORK MUST COMPLY WITH THE REQUIREMENTS OF NFPA 70 (NATIONAL ELECTRICAL CODE), NFPA 70B, NFPA 70E, IECC, OSHA IN ADDITION TO OTHER REFERENCES REQUIRED BY CONTRACT.
6. INSTALLATION OF SWITCHES, OUTLETS AND CONTROL DEVICES SHALL COMPLY WITH LOCAL CODES AND STATE ADA REQUIREMENTS.
7. REFER TO CIVIL PLANS FOR EXACT LOCATIONS OF ALL EQUIPMENT.
8. ALL ELECTRICAL EQUIPMENT, DEVICES AND CIRCUITS SHALL CONTAIN A GROUNDING CONDUCTOR. CONDUIT SYSTEM SHALL NOT BE USED AS GROUNDING NETWORK. ALL GROUNDING SHALL BE IN STRICT COMPLIANCE WITH ARTICLE 250 OF THE NATIONAL ELECTRICAL CODE.
9. COORDINATE LOCATION AND VERIFY REQUIREMENTS OF ALL EXTERIOR UTILITY EQUIPMENT AND METER BASE WITH OWNER AND UTILITY COMPANY. UTILITY PROVIDER FOR THE PROJECT IS A.E.P. CONTRACTOR RESPONSIBLE FOR PROVIDING UTILITY SERVICE PROVIDER WITH LOAD FORMS AND ALL INFORMATION REQUIRED FOR NEW SERVICE INSTALLATION PER UTILITY COMPANY STANDARDS. COORDINATE WITH UTILITY COMPANY FOR EXACT SERVICE POINT, POLE, AND TRANSFORMER LOCATIONS.
10. UTILITY SECONDARY TRENCH AND CONDUIT REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE UTILITY COMPANY SPECIFICATIONS. COORDINATE WITH UTILITY COMPANY. PROVIDE AND INSTALL ALL MATERIAL AND EQUIPMENT AS REQUIRED FOR COMPLETE JOB INSTALLATION.
11. ALL SWITCHBOARDS, PANELBOARDS, TRANSFORMERS, DISCONNECT SWITCHES AND OTHER ELECTRICAL DEVICES AND EQUIPMENT SHALL HAVE ENGRAVED NAMEPLATES INDICATING EQUIPMENT IDENTIFICATION TAG AND VOLTAGE, AS WELL AS WHERE DEVICE IS FED FROM. ALL SWITCHBOARDS AND PANELBOARDS SHALL HAVE TYPED DIRECTORIES INDICATING DISTRIBUTION AND BRANCH CIRCUIT FEEDERS.
12. CONTRACTOR IS RESPONSIBLE FOR NATIONAL ELECTRICAL CODE REQUIRED CLEARANCES AROUND AND ABOVE ALL ELECTRICAL EQUIPMENT AND DEVICES.
13. SHORT CIRCUIT AMPERE INTERRUPTING CAPACITY (A.I.C.) RATING OF ALL ELECTRICAL PRODUCTS SHALL BE GREATER THAN THE MAXIMUM AVAILABLE SHORT CIRCUIT CURRENT.
14. WIRE AND CONDUIT SIZES SHALL BE INSTALLED AND SIZED TO COMPENSATE FOR VOLTAGE DROP PER THE NATIONAL ELECTRICAL CODE.
15. ALL ELECTRICAL AND ELECTRONIC COMPONENTS EXPOSED TO WEATHER SHALL BE RATED AT NEMA 4X; INCLUDING, BUT NOT LIMITED TO: DISTRIBUTION PANELS, JUNCTION BOXES, RECEPTACLES, OUTLETS, PERIPHERALS, SENSORS, TRANSMITTERS, KEYPADS, AND THE FASTENERS USED/CONNECTIONS MADE THEREFORE.
16. ALL LIGHT POLE AND RVSS TOWER HAND HOLES AND ACCESS PANELS BELOW 20'-0" ABOVE GROUND SHALL EMPLOY PROPRIETARY GEOMETRY, HIGH LEVEL SECURITY, TAMPER-PROOF FASTENERS THAT WILL NOT PROMOTE DISSIMILAR METALS CORROSION.

RVSS TOWER GROUNDING GENERAL NOTES

1. AS PART OF THE WORK, THE CONTRACTOR WILL BE RESPONSIBLE FOR PROVIDING AND INSTALLING A EARTH ELECTRODE SYSTEM (EES) AT THE BASE OF EACH OF THE RVSS TOWER LOCATIONS INDICATED ON THE PLANS. EES SHALL BE UTILIZED FOR FUTURE CONNECTION OF TOWER GROUNDING, TOWER LIGHTNING PROTECTION, ELECTRICAL/FIBER EQUIPMENT AND ENCLOSURE GROUNDING, FENCING / BOLLARDS, AND RVSS UPS EQUIPMENT GROUNDING. FINAL CONNECTIONS TO FUTURE OR OWNER PROVIDED EQUIPMENT NOT INDICATED TO BE INSTALLED ON THESE PLANS SHALL BE BY OTHERS.
2. ALL GROUNDING AT RVSS TOWERS SHALL CONFORM TO FAA-STD-019E AS A MINIMUM.
3. GROUNDING ELECTRODE SYSTEM SHALL BE USED FOR LIGHTNING PROTECTION OF THE FUTURE RVSS TOWER, AND AS SUCH, SYSTEM SHALL BE INSTALLED AND LABELED IN ACCORDANCE WITH ALL UL 96A AND NFPA 780 REQUIREMENTS.
4. SITE SURVEY: A SITE SURVEY SHALL BE CONDUCTED BY THE CONTRACTOR FOR BOTH RVSS SITES INDICATED ON THESE PLANS TO DETERMINE THE GEOLOGICAL AND OTHER PHYSICAL CHARACTERISTICS OF THE SURROUNDING EARTH. INFORMATION TO BE COLLECTED SHALL INCLUDE LOCATION OF ROCK FORMATIONS, GRAVEL DEPOSITS, SOIL TYPES ETC. PERFORM A SOIL RESISTIVITY TEST AT PROBE SPACINGS OF 10, 20, 30 AND 40 FEET IN FOUR DIRECTIONS FROM THE PROPOSED RVSS TOWER AND EQUIPMENT. ALL SURVEY DATA, INCLUDING SOIL RESISTIVITY MEASUREMENTS, SHALL BE NOTED ON A SCALED DRAWING OR SKETCH OF THE SITE AND SUBMITTED TO THE ENGINEER FOR REVIEW.
5. SHOP DRAWINGS: CONTRACTOR SHALL PROVIDE SHOP DRAWINGS OF THE PROPOSED EES TO THE ENGINEER FOR REVIEW AND APPROVAL, INDICATING LOCATIONS OF ALL GROUNDING ELECTRODES, GROUNDING CONDUCTORS, AND OTHER GROUNDING ACCESSORIES AS REQUIRED. THE EES SHALL CONSIST OF AT LEAST (4) DRIVEN GROUND RODS (CONFIGURATION AND DEPTH BASED ON SOIL TEST), SUPPLEMENTAL GROUNDING ELECTRODES (IF REQUIRED), AND BURIED INTERCONNECTING CONDUCTORS. THE SITE SURVEY INFORMATION SHALL BE USED AS THE BASIS FOR THE DESIGN OF THE EES. THE RESISTANCE TO EARTH OF THE EES SHALL BE NOT OVER 10 OHMS. WHERE CONDITIONS ARE ENCOUNTERED SUCH AS ROCK NEAR THE SURFACE, SHALLOW SOILS, PERMAFROST AND SOILS WITH LOW MOISTURE OR MINERAL CONTENT, A SUPPLEMENTAL GROUNDING ELECTRODE MAY BE REQUIRED TO BE USED.
6. SUPPLEMENTAL GROUNDING ELECTRODES: GROUND DISSIPATION PLATES MAY BE USED. IN SHALLOW SOIL LOCATIONS WITH LIMITED SURFACE SPACE, GROUND DISSIPATION PLATES SHALL BE ALLOWED IN PLACE OF GROUND RODS IN THE EARTH ELECTRODE SYSTEM (EES). THE PLATES SHALL BE INSTALLED AT THE CORNERS OF THE EES AT THE FARTHEST ACCESSIBLE POINT FROM THE RVSS TOWER. PLATES SHALL BE CONSTRUCTED OF A MINIMUM ONE QUARTER-INCH THICK COPPER AND BE A MINIMUM OF TWO FEET SQUARE. THESE PLATES SHOULD BE INSTALLED IN A VERTICAL PLANE TO TAKE ADVANTAGE OF SEASONAL MOISTURE AND TEMPERATURE CHANGES IN THE SOIL. INSTALL THE PLATES AT THE SAME DEPTH OR DEEPER THAN THE INTERCONNECTING CONDUCTOR, BUT MAINTAIN A MINIMUM OF ONE-FOOT OF NATIVE SOIL ABOVE THE UPPER EDGE OF THE PLATE. ATTACHMENT TO THE EES SHALL BE WITH A 4/0 AWG BARE STRANDED COPPER CONDUCTOR, EXOTHERMICALLY WELDED TO THE EES AND THE PLATE. THE ATTACHMENT POINT AT THE PLATE SHALL BE AT THE CENTER OF THE PLATE, NOT NEAR THE EDGE OR THE CORNERS. THEY SHALL BE CONFIGURED AS A JORDAN DISSIPATION PLATE DESIGN OR EQUAL.
7. INTERCONNECTIONS: GROUND RODS AND GROUNDING ELECTRODES OF THE EES SHALL BE INTERCONNECTED BY A BURIED, BARE, 4/0 AWG COPPER CONDUCTOR. THE CONDUCTOR SHALL BE BURIED AT 30" BELOW GRADE LEVEL. CONNECTIONS TO THE GROUNDING ELECTRODES SHALL BE EXOTHERMICALLY WELDED. THE INTERCONNECTING CONDUCTOR SHALL CLOSE ON ITSELF FORMING A COMPLETE LOOP WITH THE ENDS EXOTHERMICALLY WELDED. THE BONDING RESISTANCE OF ALL INTERCONNECTIONS SHALL BE ONE MILLIOHM OR LESS FOR EACH BOND WHEN MEASURED WITH A 4-TERMINAL MILLIOHM METER.
8. A MINIMUM OF ONE ACCESS WELL SHALL BE INSTALLED FOR THE EES. THE WELL SHOULD BE LOCATED AT A GROUND ROD THAT IS IN AN AREA WITH ACCESS TO THE OPEN SOIL, SO THAT CHECKS OF THE EES CAN BE MADE ONCE THE FACILITY IS IN USE. THE ACCESS WELL SHALL BE MADE FROM CLAY PIPE, POURED CONCRETE, OR OTHER APPROVED WALL MATERIAL AND SHALL HAVE A REMOVABLE COVER. THE ACCESS WELL SHALL BE CONSTRUCTED TO PROVIDE A MINIMUM CLEARANCE (12 INCHES RADIUS) FROM THE CENTER OF THE GROUND ROD TO THE INSIDE WALL OF THE ACCESS WELL. THE ACCESS WELL SHALL HAVE AN OPENING OF A MINIMUM 12 INCH RADIUS. CONNECTIONS SHALL BE BY EXOTHERMIC WELDS.
9. CONTRACTOR SHALL STAKE OUT THE EXACT LOCATION OF THE BURIED GROUND LOOP CONDUCTOR IN THE FIELD AFTER INSTALLATION, SO THAT IT CAN BE TIED INTO WITH EQUIPMENT AND TOWER GROUND CONDUCTORS BY OTHERS WITH MINIMUM EXCAVATION.
10. GROUND RODS SHALL BE COPPER CLAD STEEL, MINIMUM 10 FEET IN LENGTH AND 3/4" IN DIAMETER. ROD CLADDING SHALL NOT BE LESS THAN 1/100" THICK. GROUND RODS SHALL BE AS WIDELY SPACED AS POSSIBLE, AND IN NO CASE SPACED LESS THAN ONE ROD LENGTH. TOPS OF GROUND RODS SHALL BE NOT LESS THAN 6 INCHES BELOW GRADE LEVEL.
11. GROUND LOOP CONDUCTOR TRENCH SHALL BE EXCAVATED TO 36" BELOW GRADE. CONDUCTOR SHALL BE INSTALLED AT 30" BELOW GRADE. BOTTOM 12" OF TRENCH SHALL BE BACKFILLED WITH BENTONITE/EARTH MIX BACKFILL. REMAINDER OF TRENCH SHALL BE BACKFILLED WITH COMPACTED BACKFILL.
12. CONTRACTOR SHALL PROVIDE AND INSTALL A 24" X 2" X 1/4" COPPER GROUND BAR ON THE INTERIOR WALL OF THE RVSS TOWER EQUIPMENT SHELTER, WITH ISOLATORS AND PRE-DRILLED GROUNDING HOLES. CONNECT GROUND BAR WITH 4/0 AWG GROUND CONDUCTOR TO GROUND LOOP. GROUND BAR SHALL BE USED FOR PANEL/TRANSFORMER/EQUIPMENT GROUNDING CONNECTIONS PER CODE REQUIREMENTS WITHIN EQUIPMENT SHELTER.
13. THE GROUNDING SYSTEM SHALL BE CONSTRUCTED IN ACCORDANCE WITH UL 96 AND NFPA 780 REQUIREMENTS. CERTIFICATION SHALL BE PERFORMED BY AN INDEPENDENT, THIRD-PARTY INSPECTION FIRM. THE INSPECTION FIRM CANNOT BE THE SYSTEM DESIGNER OR INSTALLER.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

DESIGNED BY: M.J. HILL
DRAWN BY: D.A. NELSON
CHECKED BY:
SUBMITTED BY:
SIZE: ANSI D
ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

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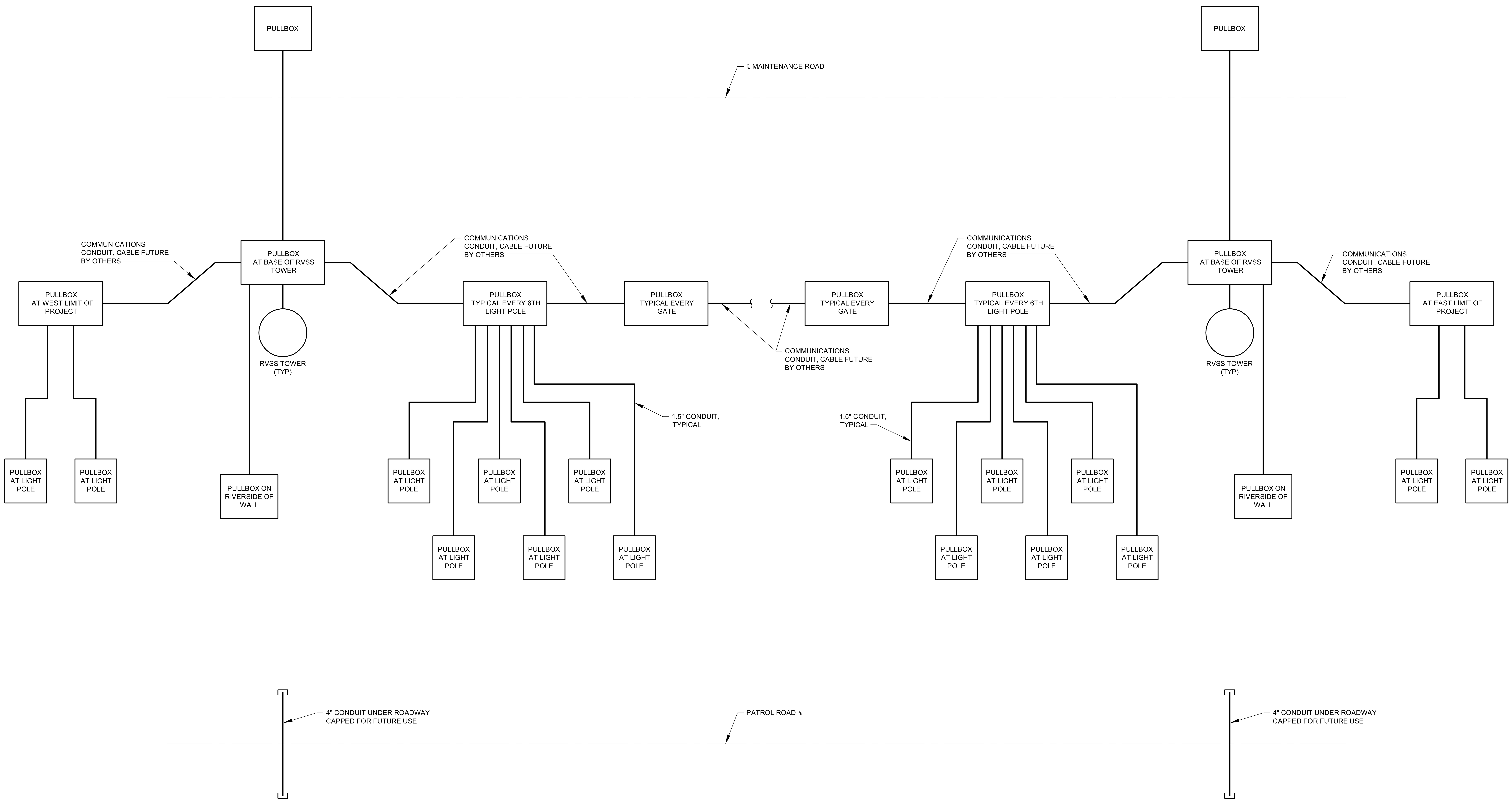
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE
ELECTRICAL AND COMMUNICATION NOTES

SHEET ID
ROMA
E-002

NOTES:

1. DUCTBANK AND QUANTITY AND SIZE OF CONDUITS BY CONTRACTOR TO BE COORDINATED WITH OWNER.



CONCEPTUAL OVERALL COMMUNICATIONS CONDUIT INFRASTRUCTURE

NO SCALE

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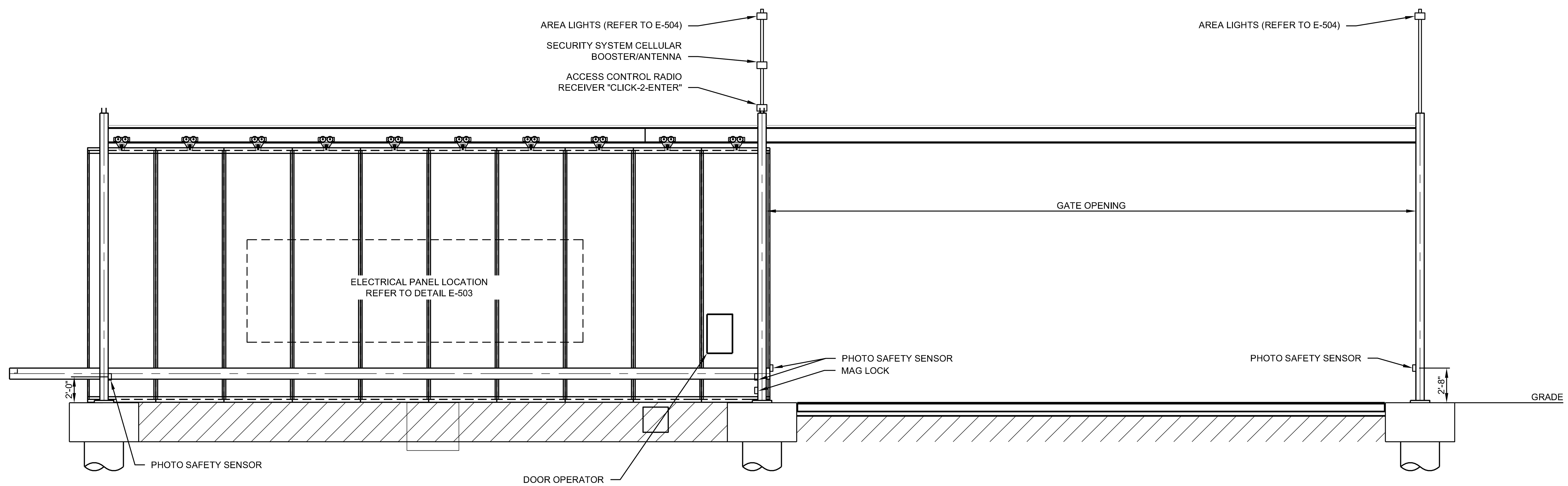
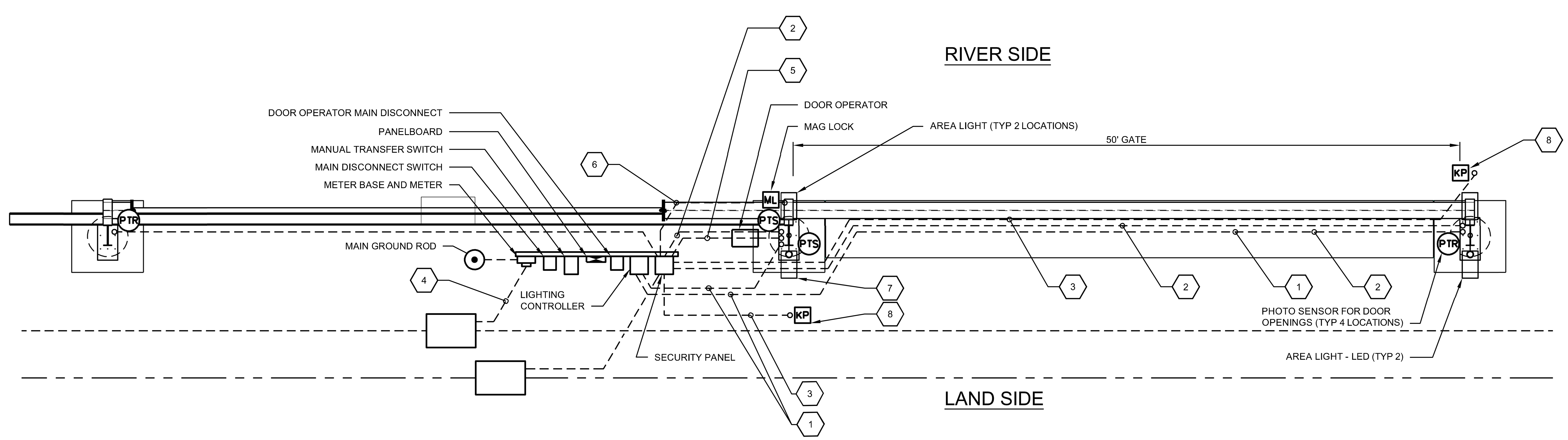
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE
CONCEPTUAL OVERALL CAMERA CONDUIT INFRASTRUCTURE

SHEET ID
ROMA
E-101



GATE PHOTOELECTRIC BEAM DEVICES MOUNTING HEIGHTS

SCALE: 3/16" = 1'-0"



GATE ELECTRICAL LAYOUT - RIGHT SIDE LAYOUT

SCALE: 3/16" = 1'-0"

AT FULL SIZE
0 1 2 3 IN
0 1 2 3 4 5 6 7 8 cm

GENERAL NOTES

1. RATING OF THE MANUAL TRANSFER SWITCH'S TRANSFER PANEL "QUICK COUPLING" SHALL BE COORDINATED WITH THE SIZE OF THE ANTICIPATED MOBILE EMERGENCY GENERATOR.
2. KEYPADS MAY NEED TO BE RE-LOCATED TO REFLECT ACTUAL SITE CONDITIONS.
3. MAGLOCK SHALL BE PLACED UNDER GATE OPERATOR.
4. UNLESS NOTED OTHERWISE, RUN UNDERGROUND CONDUITS LOCATED ALONG AND IN THE VICINITY OF THE GATE OPENING UNDER THE 4' WIDE x 8" DEEP GATE OPENING CONCRETE SLAB.

XX KEYED NOTES

1. POWER FOR AREA LIGHTS - 1" SCHEDULE 80 - TO LIGHTING CONTACTOR.
2. CONDUIT FOR PHOTO SAFETY SENSOR - 1" SCHEDULE 80 - TO SECURITY.
3. CONDUIT FOR SECURITY KEYPAD - 1" SCHEDULE 80.
4. CONDUIT FOR CONNECTION TO RGV-06 POWER DUCTBANK SCHEDULE 80.
5. CONDUIT FOR "CLICK-TO-ENTER" AND CELLULAR ANTENNA SYSTEM - 1" SCHEDULE 80.
6. CONDUIT FOR MAGNETIC LOCK - 1" SCHEDULE 80.
7. FIXTURE IDENTIFIED SHALL BE CONNECTED TO BATTERY CIRCUIT. SEE DETAIL E-605.
8. PROVIDE GOOSENECK MOUNTING ARM AND CONCRETE BASE FOR MOUNTING OF KEYPAD. SEE CIVIL PLANS FOR EXACT LOCATION OF KEYPADS.

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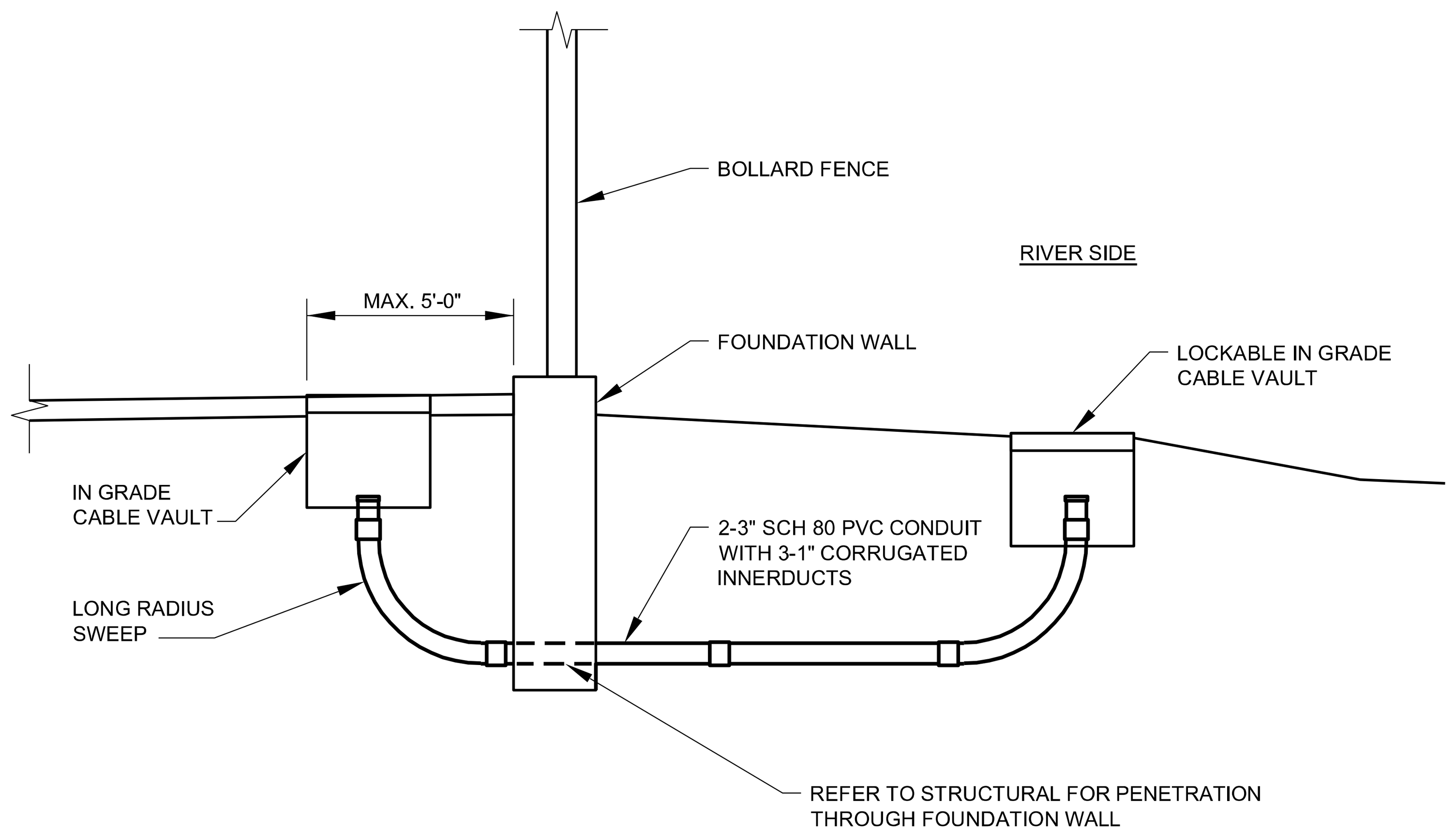
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE
ELECTRICAL SINGLE GATE - PLAN VIEW
50 FEET SINGLE LEAF AUTOMATED GATE

SHEET ID
ROMA
E-102



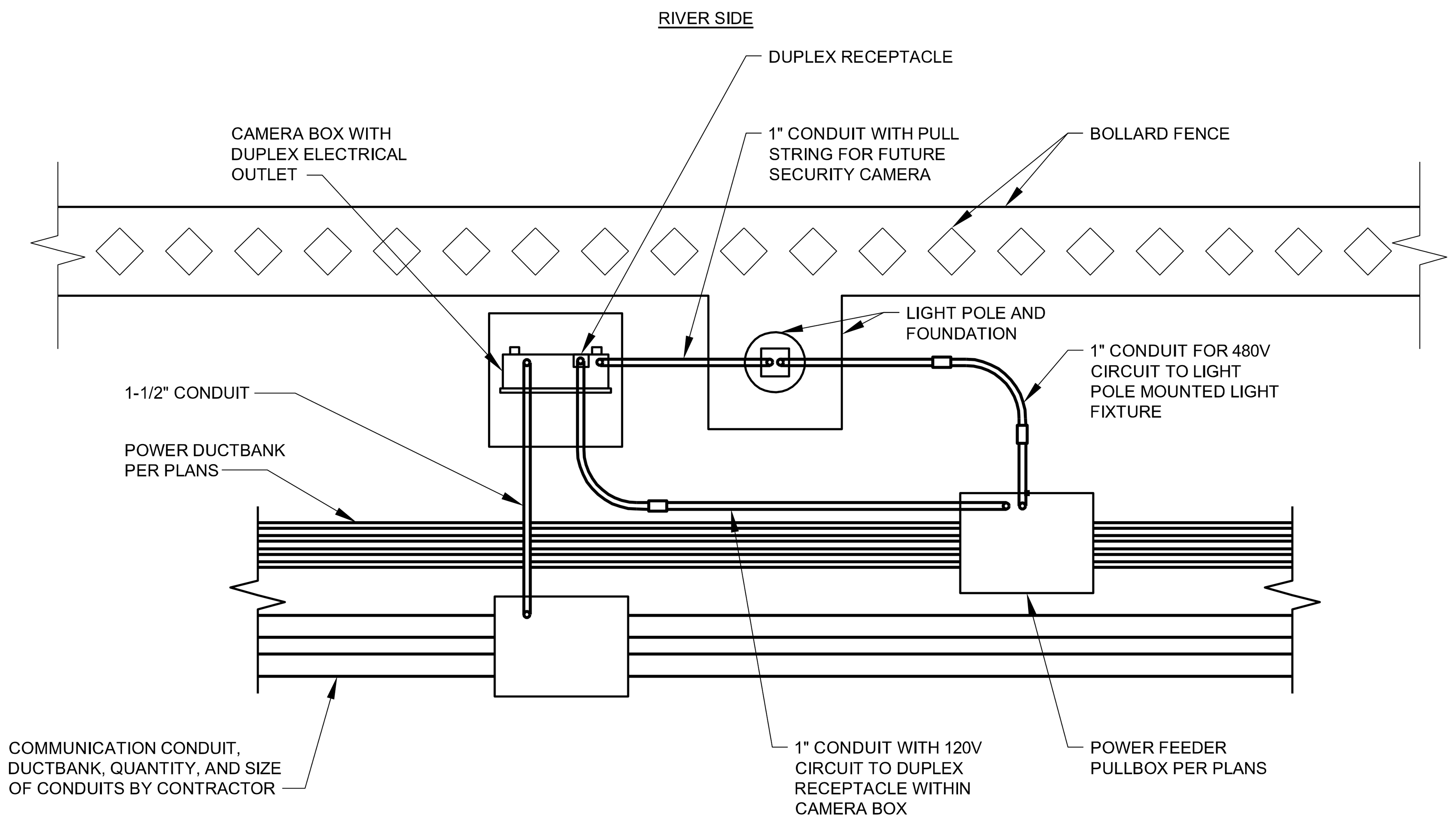
SECTION

NOTES:

1. IN ADDITION TO PENETRATIONS FOR RVSS TOWERS PROVIDE AT BEGINNING AND END OF EACH CONTRACT WALL SEGMENT FOR FUTURE CONNECTIONS.

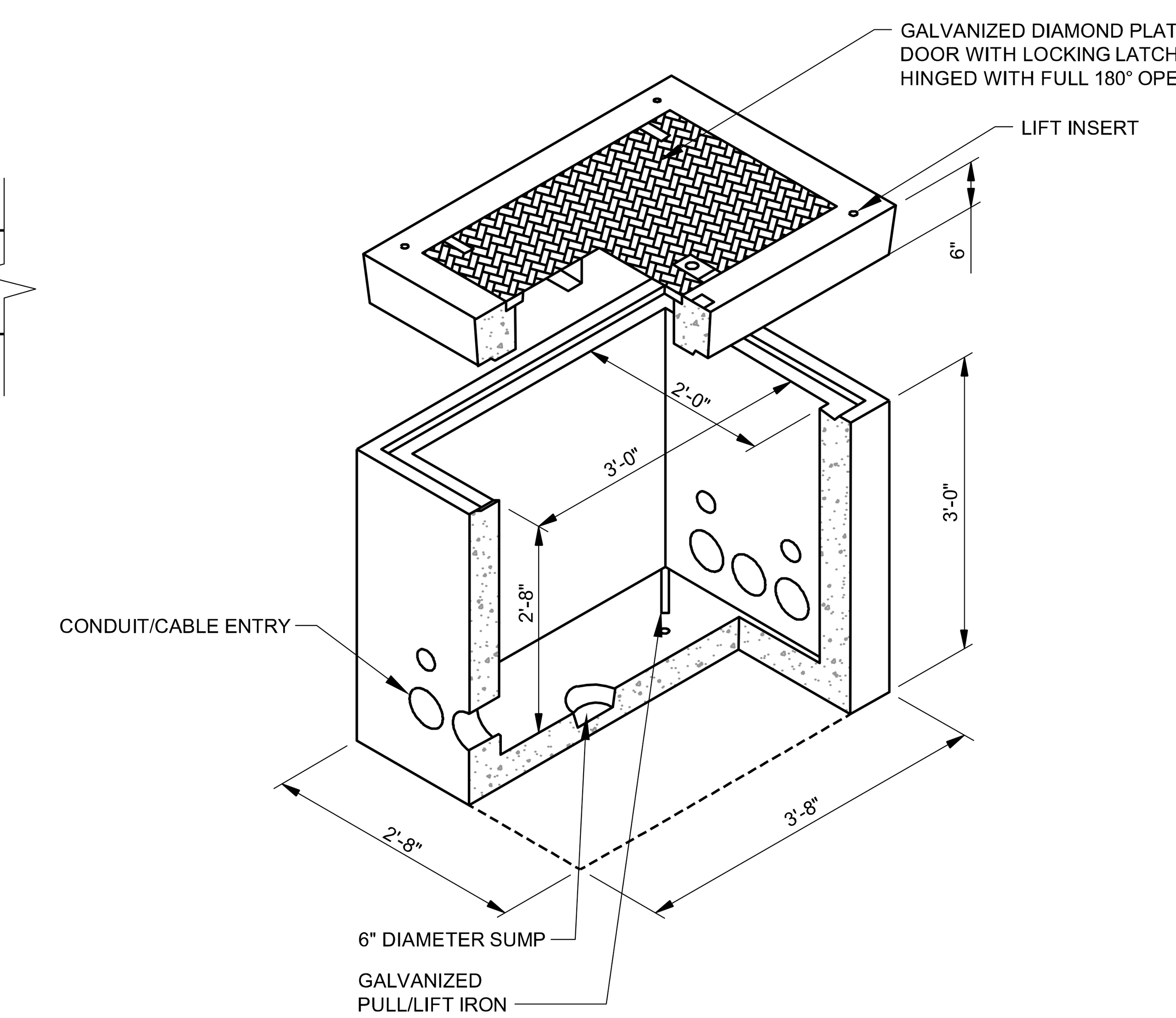
COMMUNICATIONS CONDUIT ROUTING TO RIVERSIDE

NO SCALE



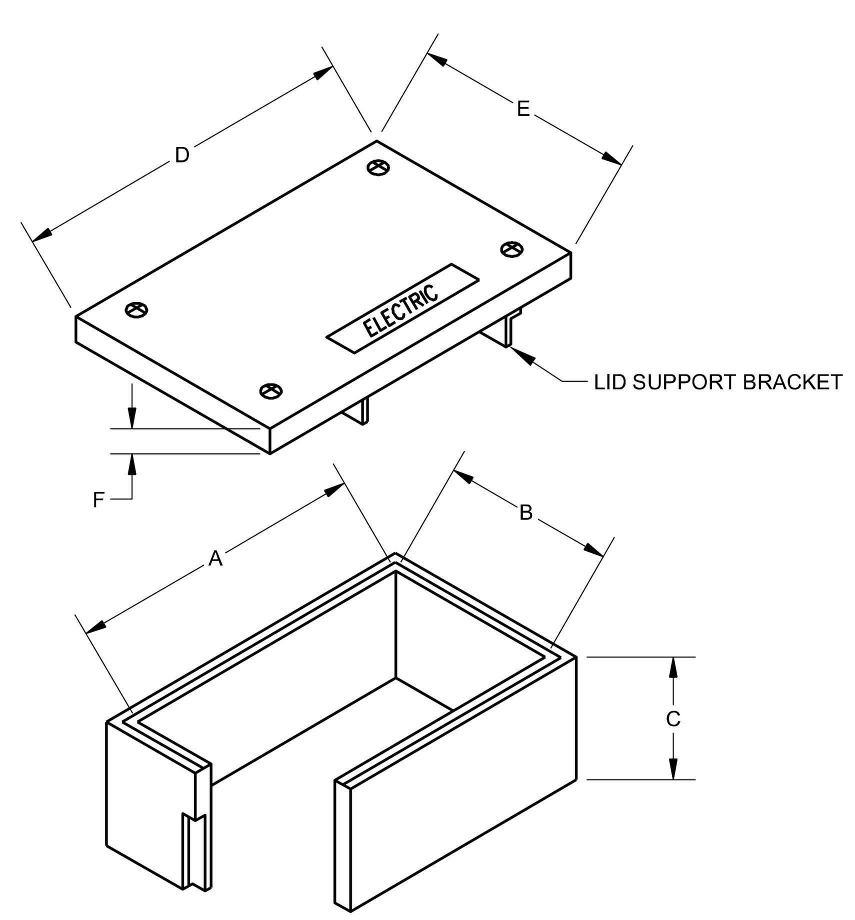
TYPICAL PLAN VIEW AT LIGHT POLES

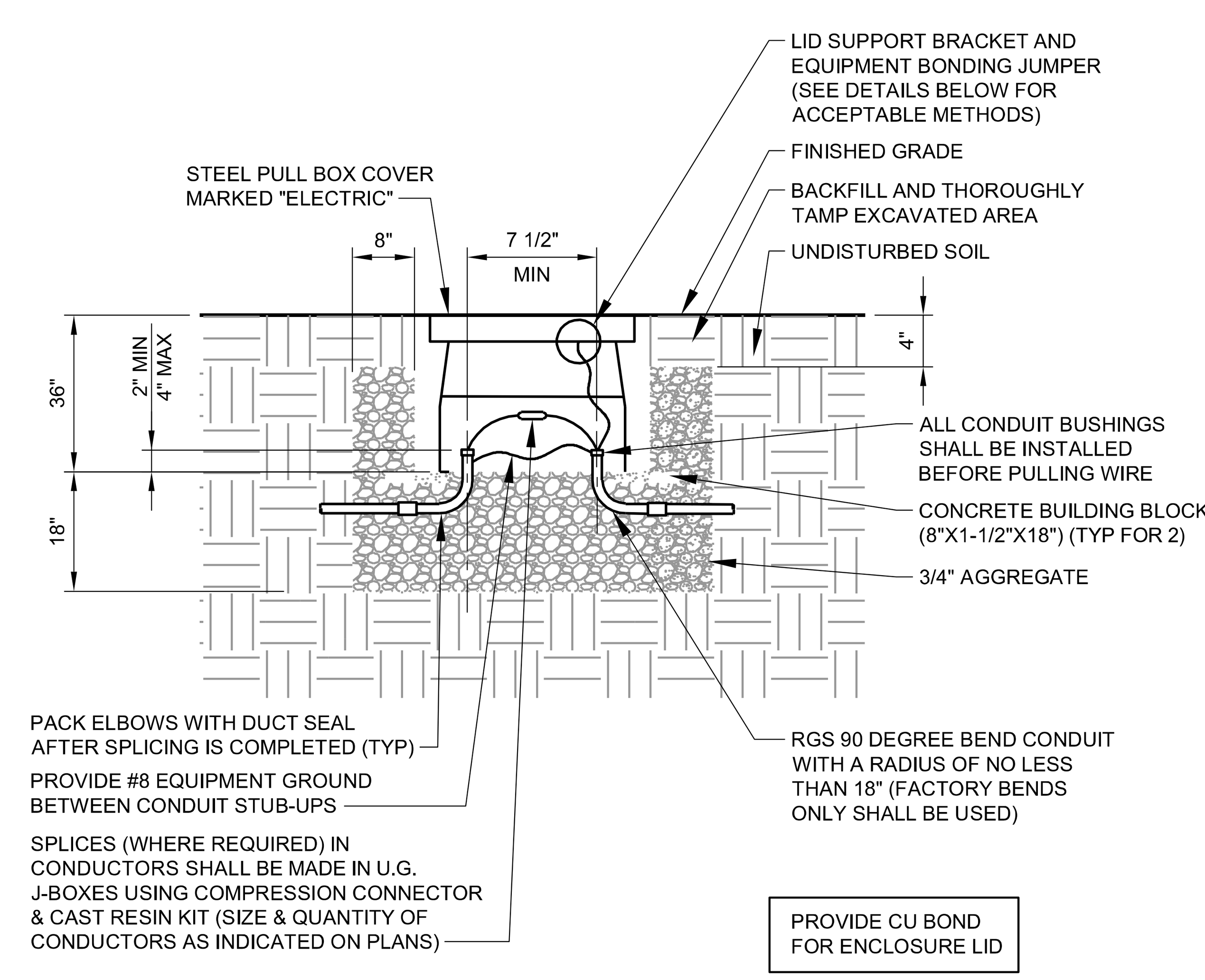
NO SCALE



UNDERGROUND COMMUNICATION CABLE VAULT DETAIL (RIVER SIDE)

NO SCALE



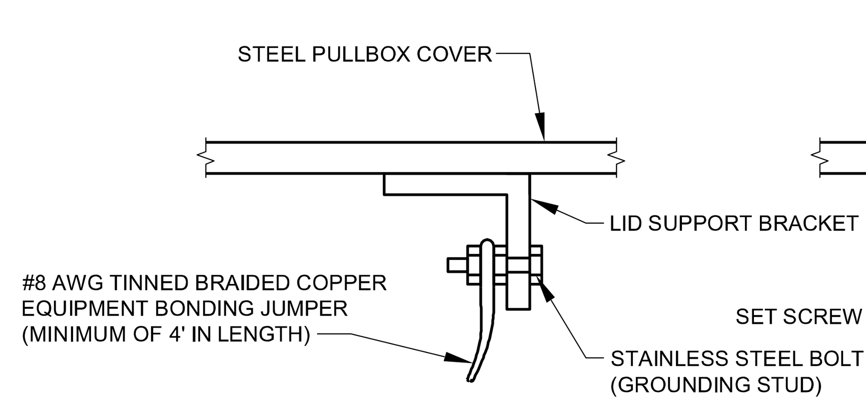


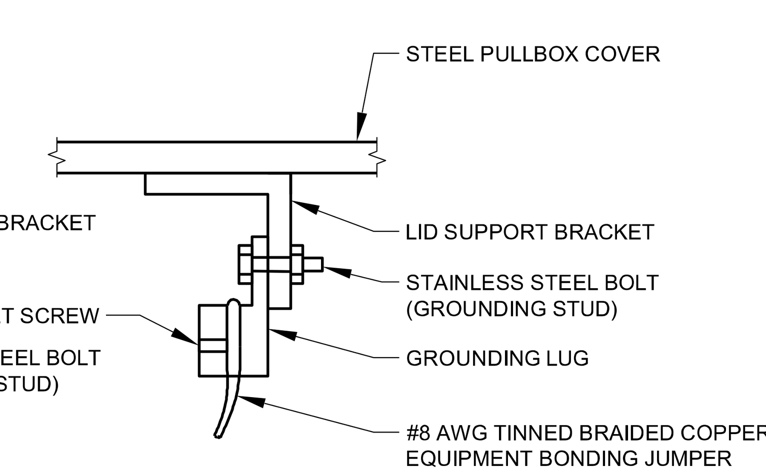
PROVIDE CU BOND FOR ENCLOSURE LID

NOTES:

1. INSTALL A 1/4"-20 NC X 3/4" STAINLESS STEEL GROUNDING STUD TO THE LID SUPPORT MEMBER(S) ON THE BOTTOM OF LID BY DRILLING A HOLE THROUGH THE "L", "C", OR "T"-SHAPED SUPPORT MEMBER. SECURE GROUNDING STUD AND BONDING JUMPER WITH TWO (2) STAINLESS STEEL NUTS AND FLAT WASHERS.

2. SECURE GROUNDING LUG TO THE LID SUPPORT MEMBERS TO THE BOTTOM OF LID BY DRILLING A HOLE THROUGH THE "L", "C", OR "T"-SHAPED SUPPORT MEMBER AND INSTALLING A 1/4"-20 NC X 3/4" STAINLESS STEEL GROUND STUD. INSERT BONDING JUMPER INTO GROUNDING LUG AND SECURE WITH SET SCREW.





TYPICAL HANDHOLE / PULL BOX DETAIL (COMM AND POWER, SECURE SIDE)

NO SCALE

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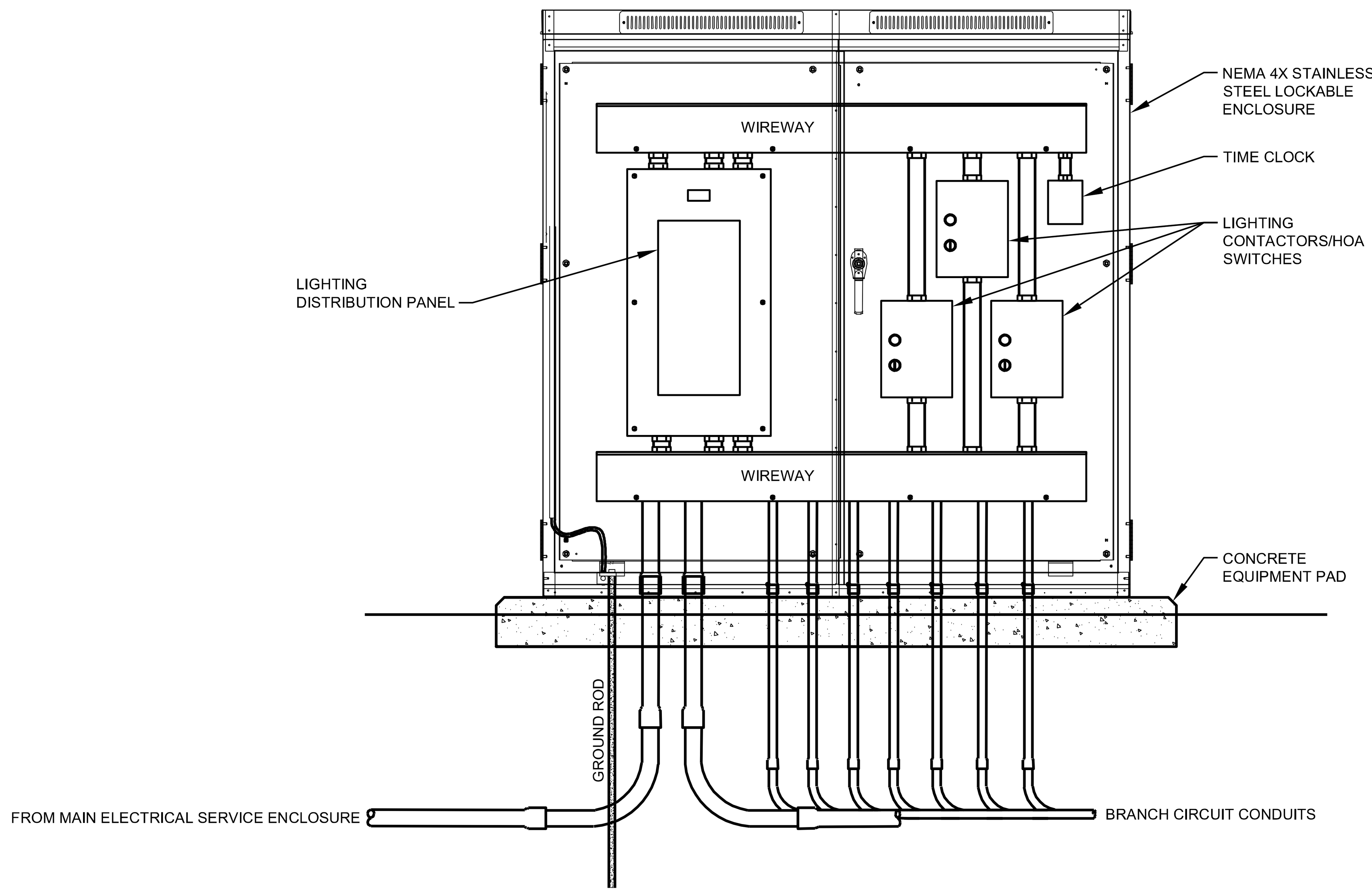
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE

CONDUIT ROUTING DETAILS

SHEET ID

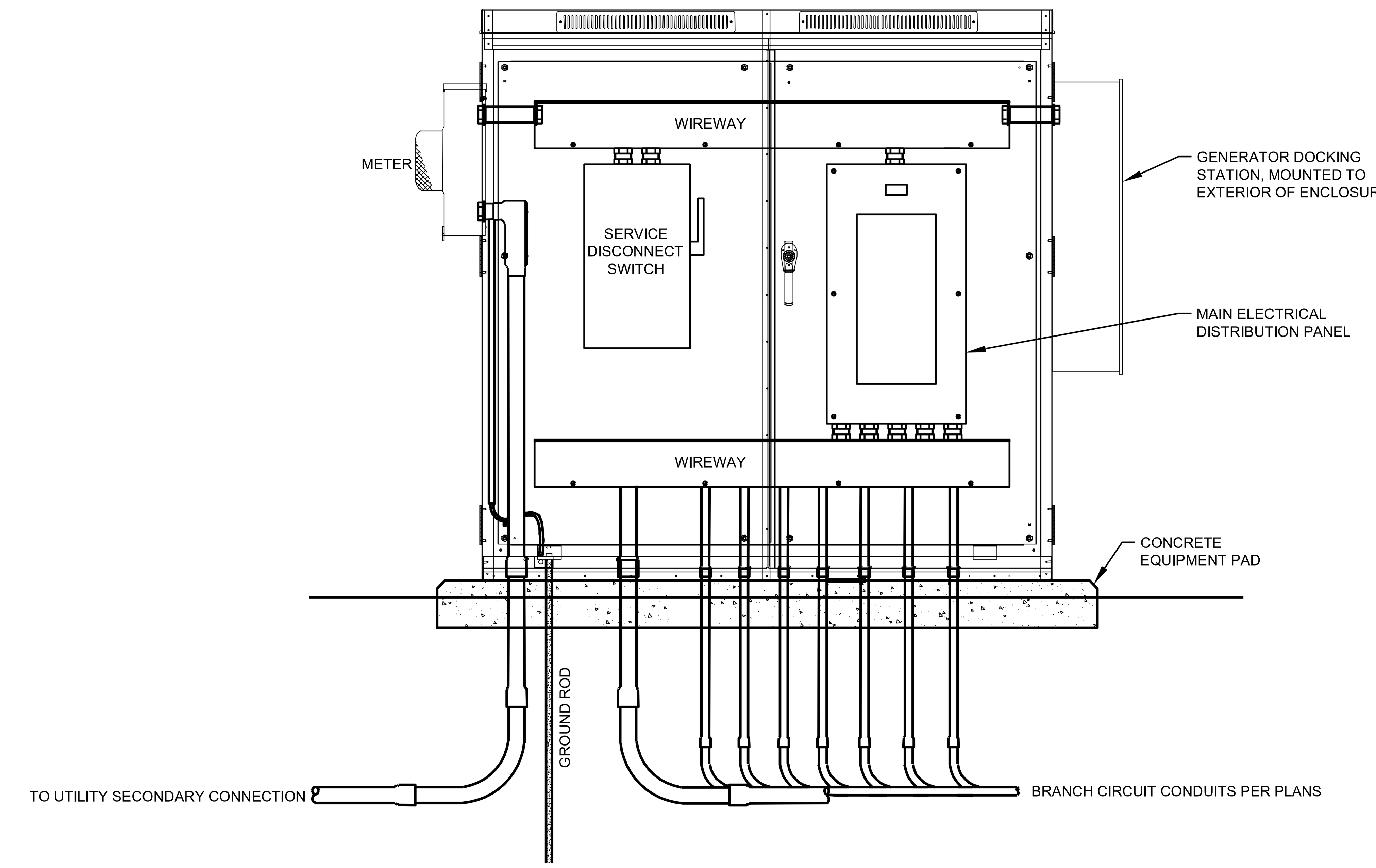
ROMA

E-501



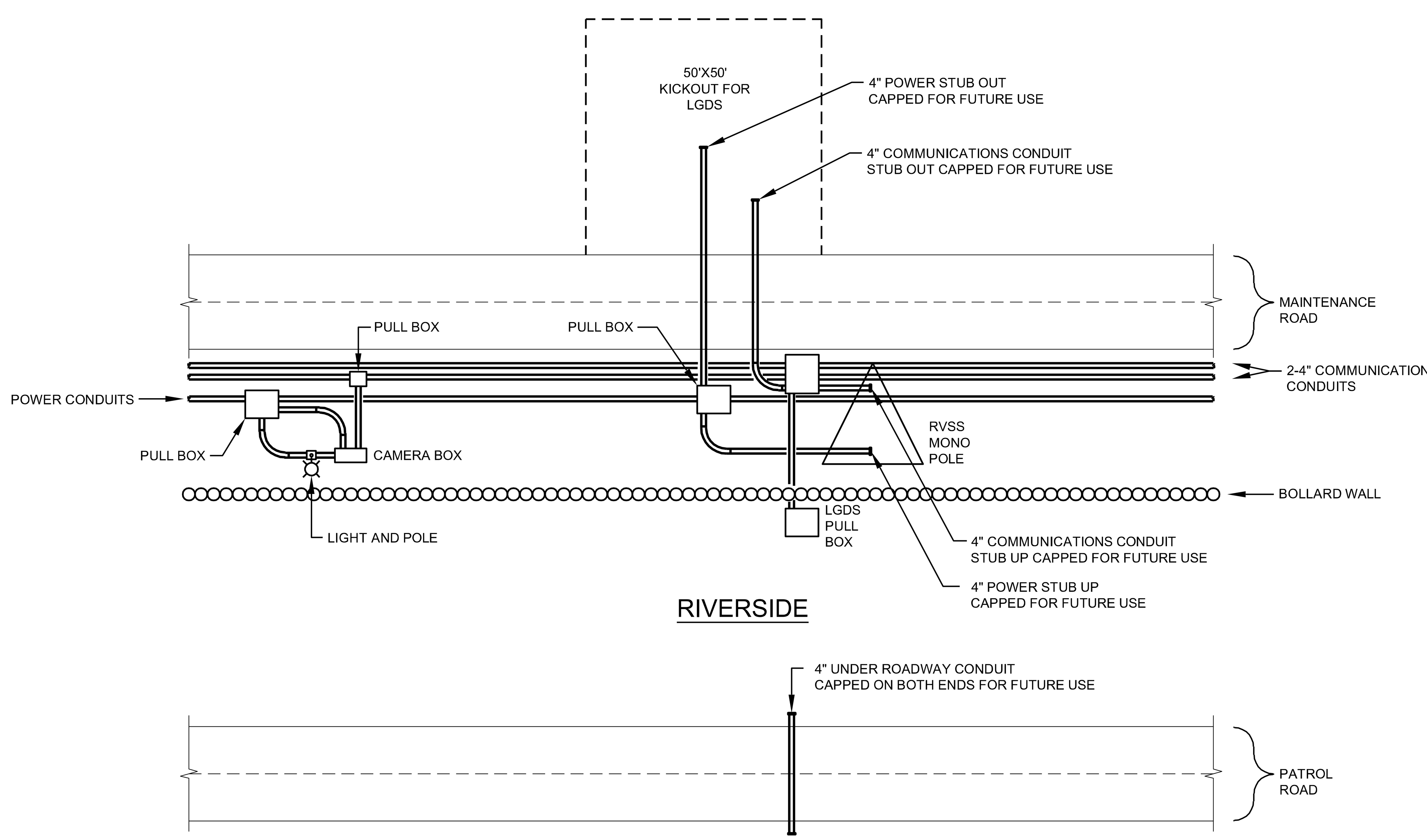
TYPICAL LIGHTING DISTRIBUTION ENCLOSURE

NOT TO SCALE



TYPICAL UTILITY CONNECTION POINT ELECTRICAL SERVICE ENCLOSURE

NOT TO SCALE



RVSS TOWER TYPICAL PLAN VIEW

NOT TO SCALE

US Army Corps of Engineers ®

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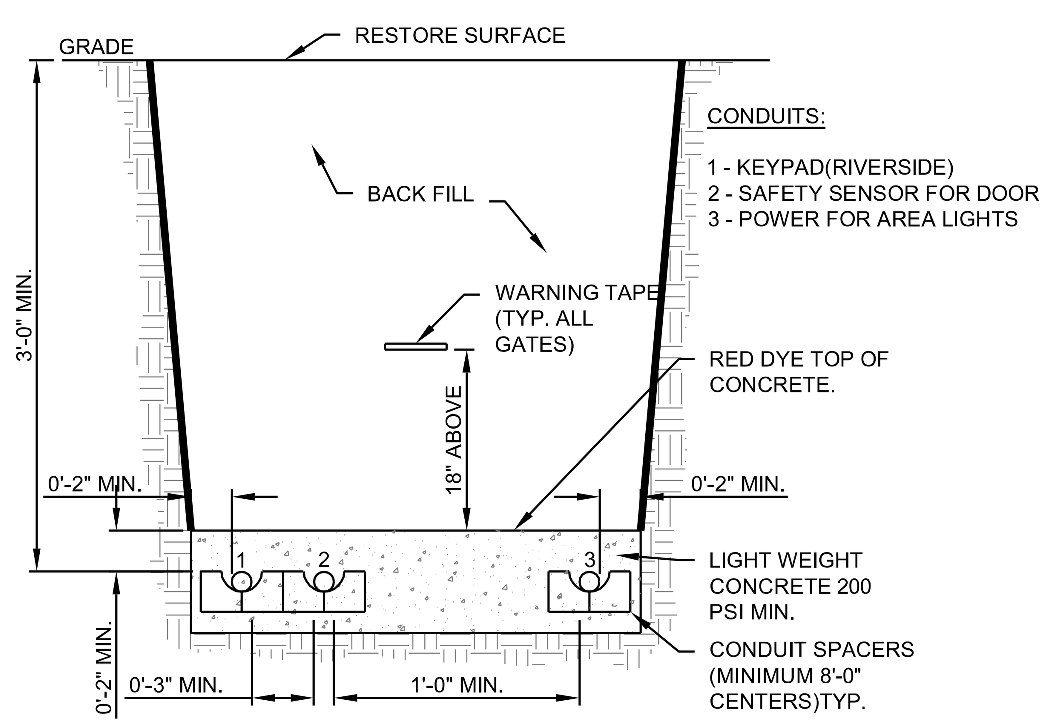
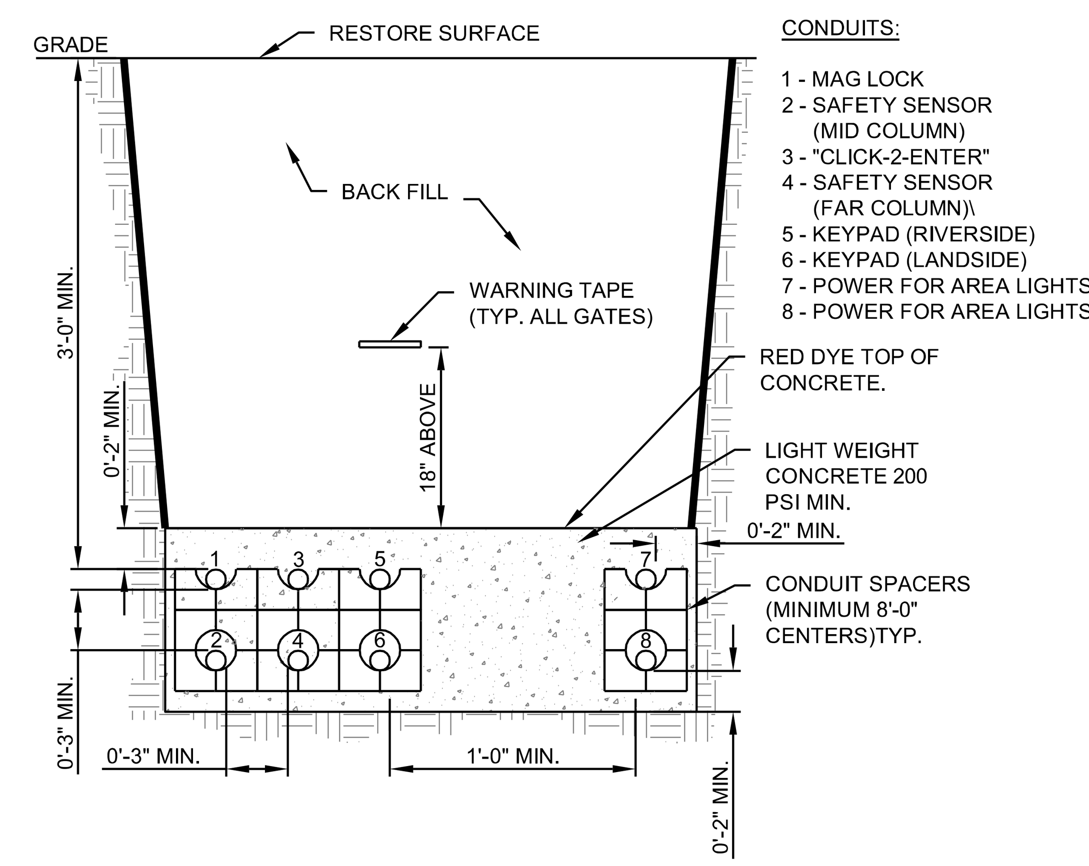
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE
RVSS TOWER YARD EQUIPMENT DETAILS

SHEET ID
ROMA
E-502



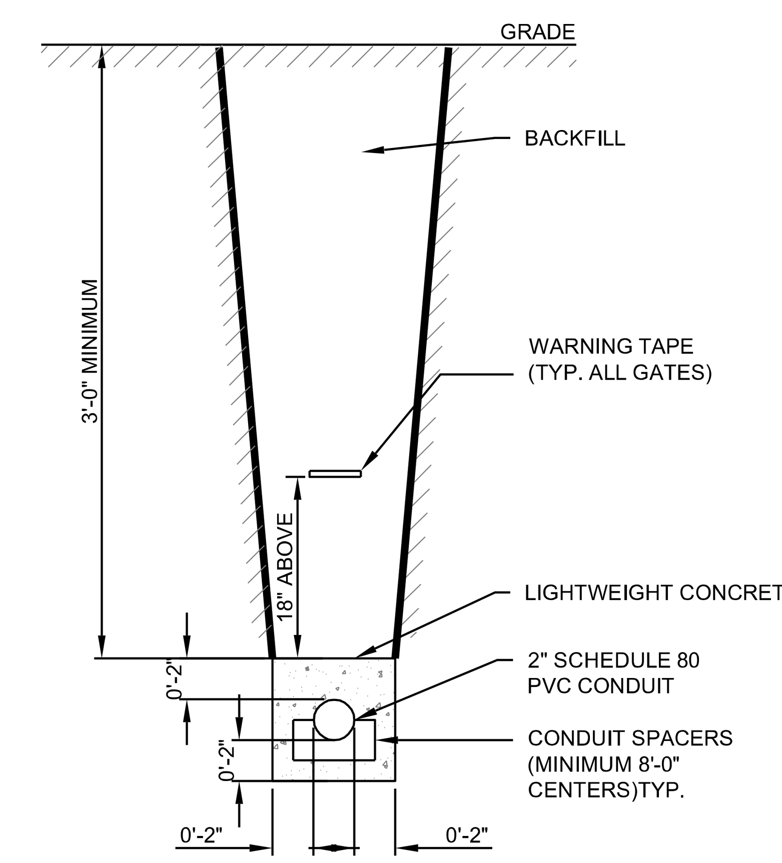
GATE POWER, SECURITY, AND CONTROLS DUCT BANK SECTION

NO SCALE



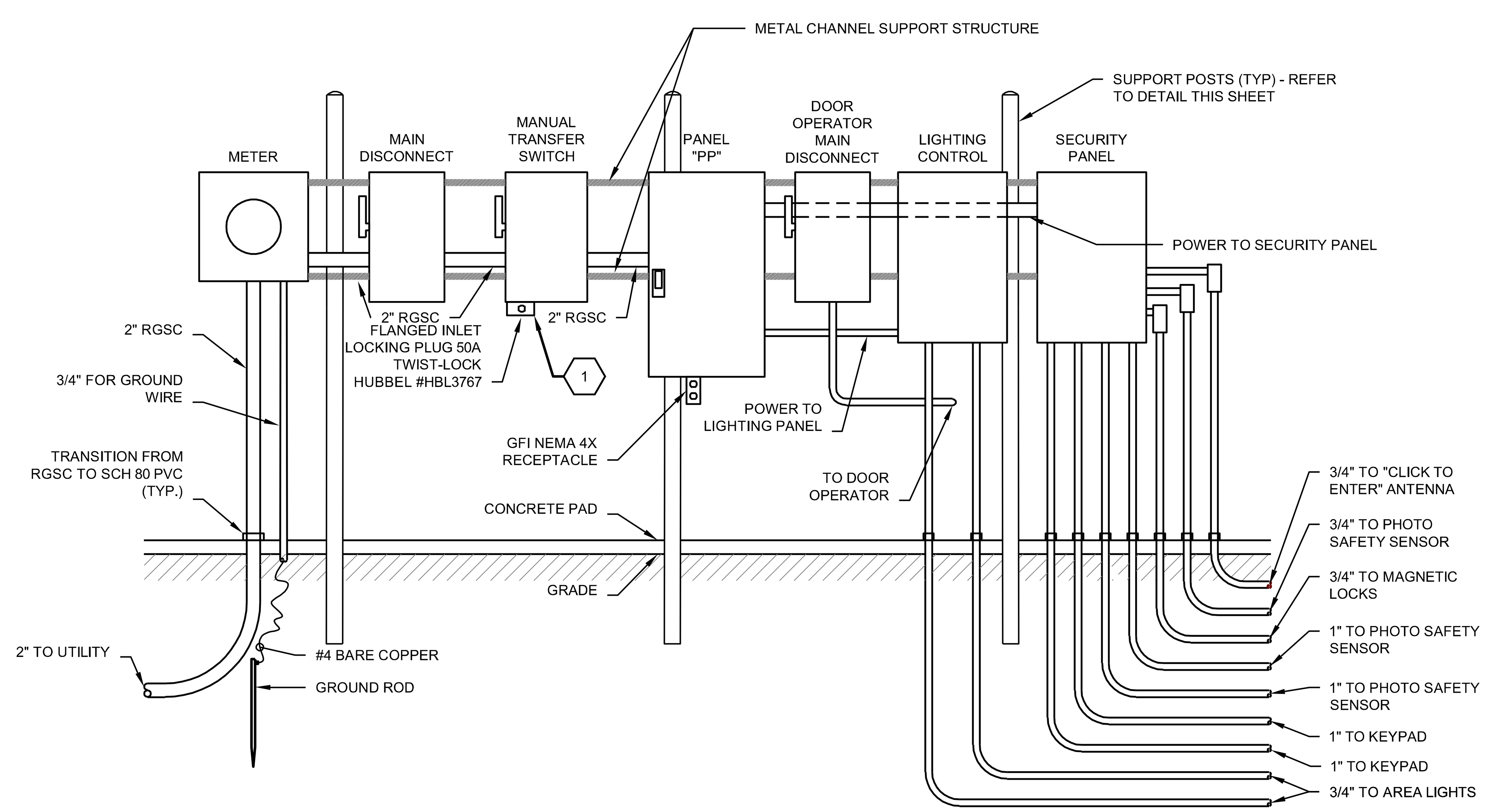
GATE POWER, SECURITY, AND CONTROLS DUCT BANK SECTION

NO SCALE



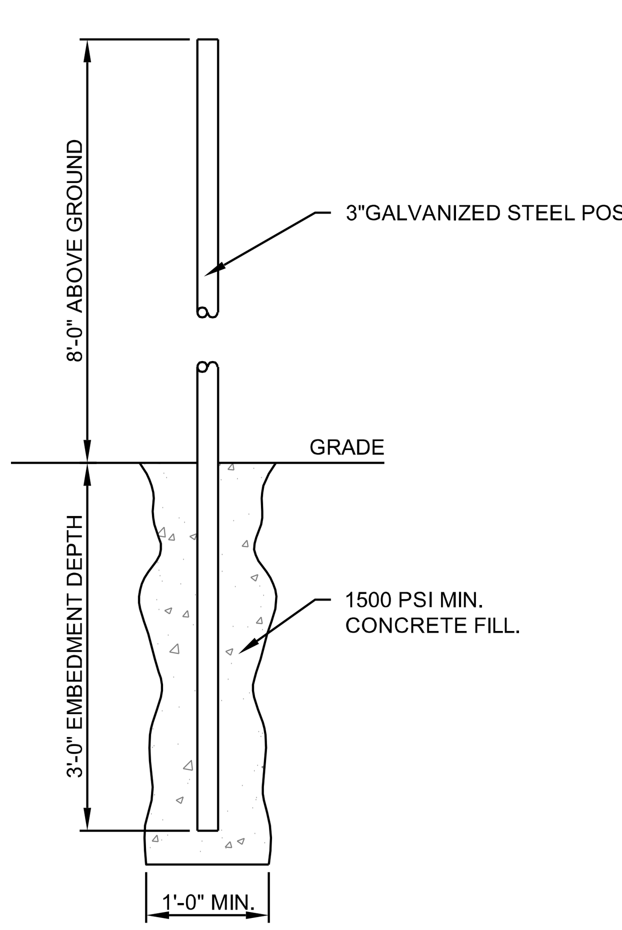
ELECTRICAL SERVICE DUCT BANK

NO SCALE



GATE POWER, SECURITY, AND CONTROLS PANEL ELEVATION DETAIL

NO SCALE



MOUNTING POLE DETAIL

NO SCALE

GENERAL NOTES

1. PROVIDE SUPPORT POSTS AND UNISTRUT MOUNTING RAILS AS REQUIRED. ALL STRUCTURE, CLAMPS AND ACCESSORIES SHALL BE CORROSION RESISTANT.
2. ALL BELOW GRADE CONDUIT SHALL BE SCHEDULE 80 PVC.
3. ALL ABOVE GRADE CONDUIT SHALL BE RIGID GALVANIZED STEEL CONDUIT.
4. ALL HARDWARE SHALL BE STAINLESS STEEL, WHERE POSSIBLE.
5. UNDERGROUND CONDUITS SHALL BE CONTINUOUSLY MARKED WITH FOIL-BACKED ELECTRICAL WARNING TAPE "CAUTION - ELECTRICAL LINE BURIED BELOW" WARNING TAPE SHALL BE INSERTED 18" ABOVE THE CENTER OF THE TOP OF THE CONDUITS.
6. WHERE ELECTRICAL EQUIPMENT IS EXPOSED TO THE ENVIRONMENT PROVIDE NEMA 4X ENCLOSURES. PROVIDE WEATHERPROOF ENCLOSURES FOR RECEPTACLES.

XX KEYED NOTES

1. THE FLANGED INLET LOCKING PLUG SHALL BE INSTALLED WITH A GASKET BETWEEN THE PLUG AND THE ENCLOSURE

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

ISSUED DATE:
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CONTRACT NO.:
FILE NUMBER:

DESIGNED BY: M.J. HILL
DRAWN BY: D.A. NELSON
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SUBMITTED BY:
SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
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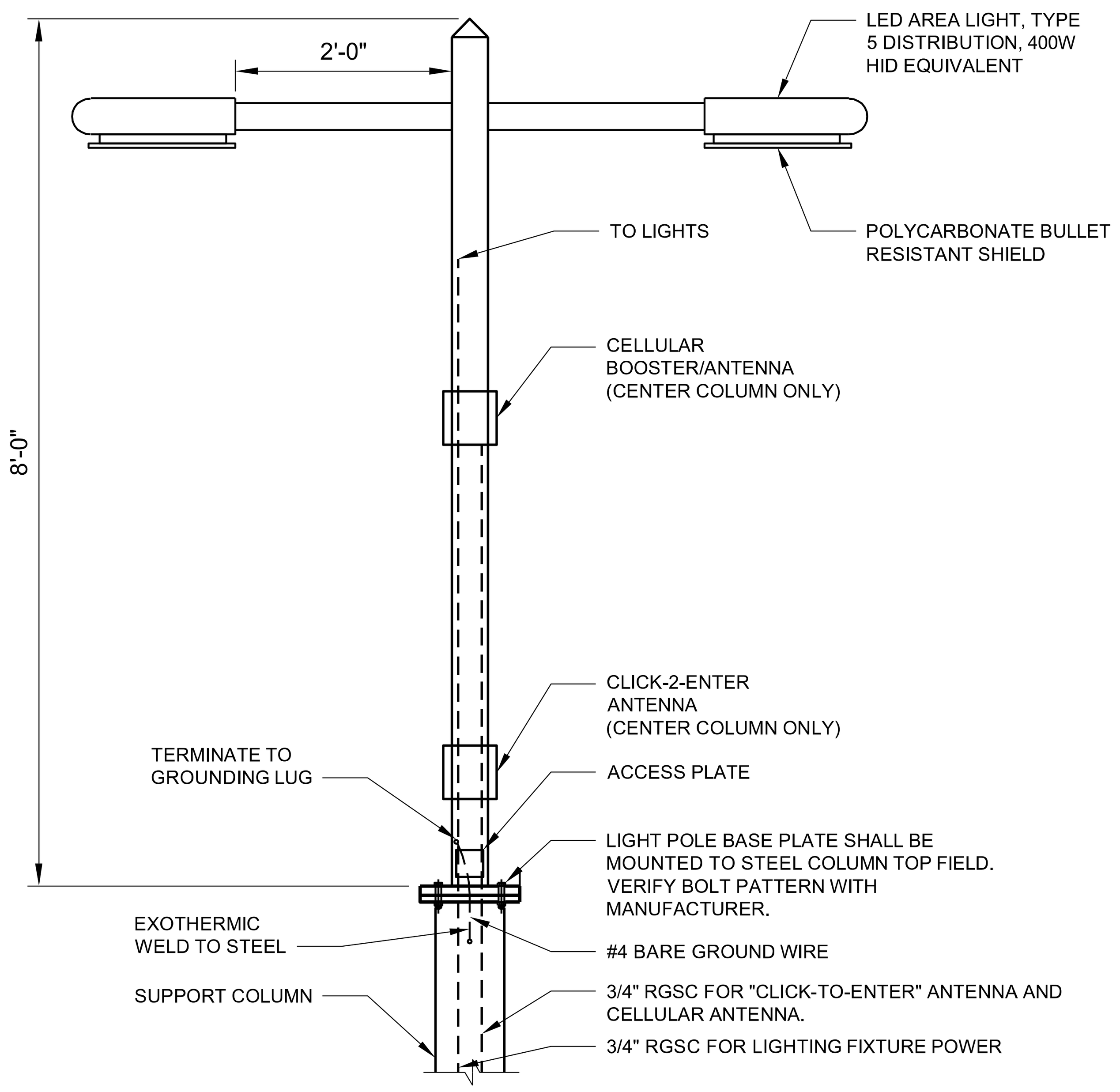
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE

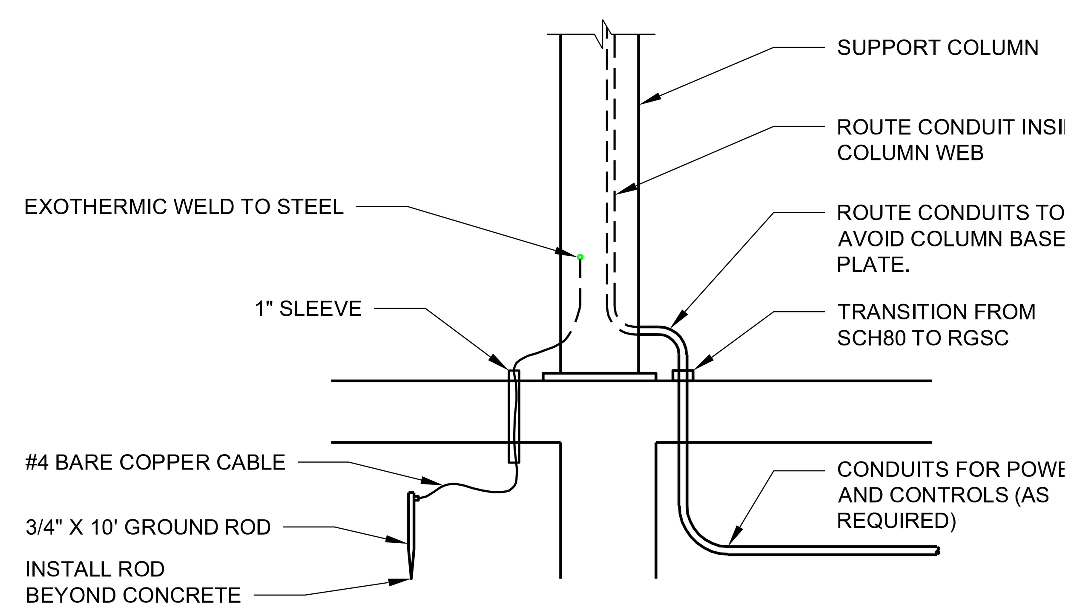
ELECTRICAL DETAILS - SHEET 1
50 FEET SINGLE LEAF AUTOMATED GATE

SHEET ID
ROMA
E-503



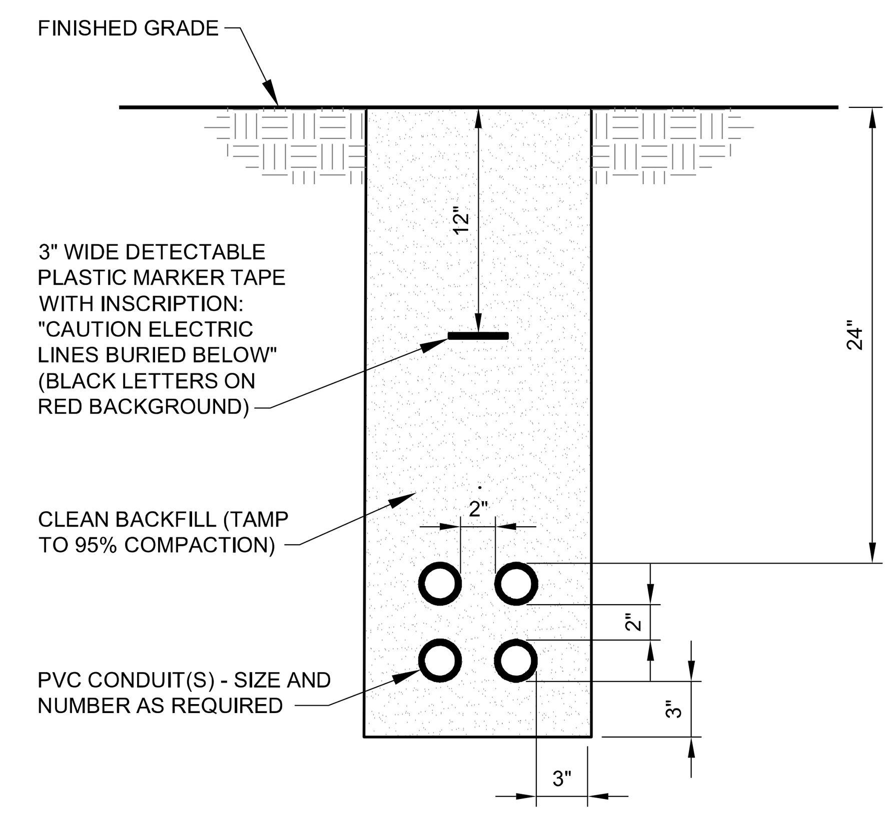
GATE LIGHT POLE DETAIL

NO SCALE



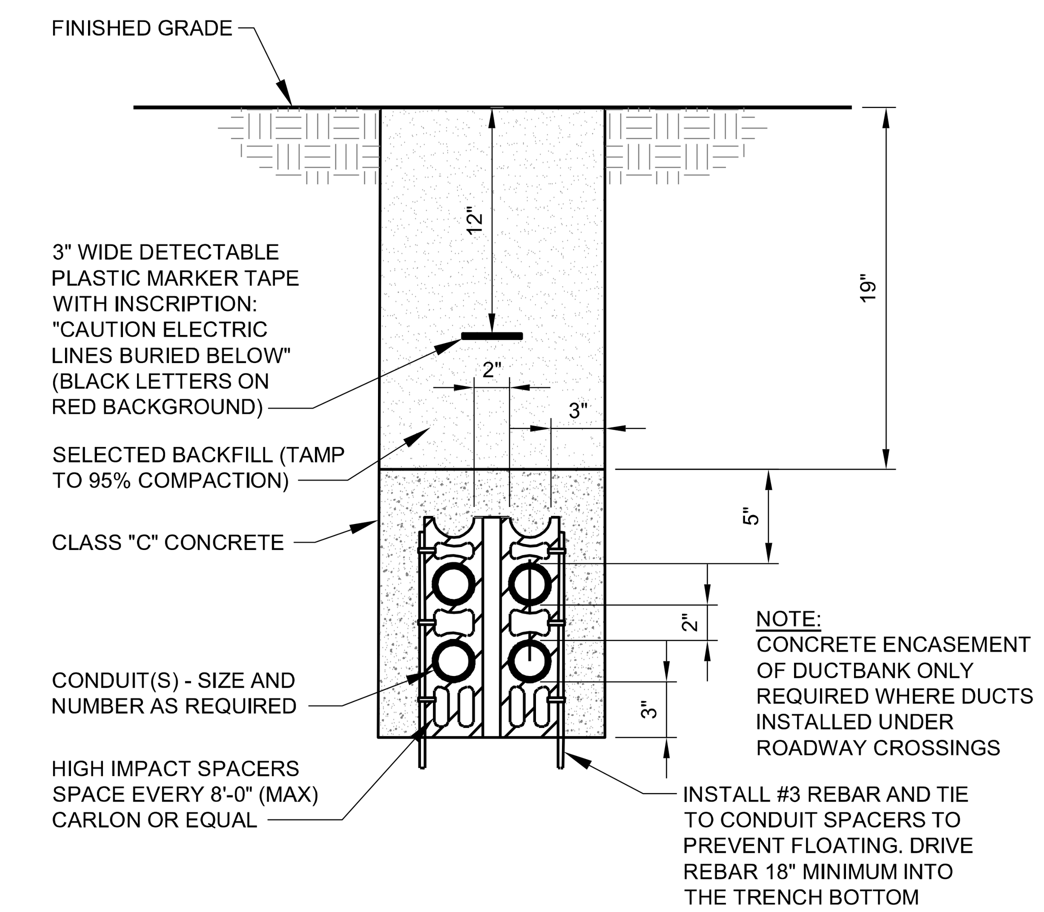
GATE POLE DETAIL AT COLUMN BASE

NO SCALE



TYPICAL DIRECT BURIED DUCTBANK DETAIL

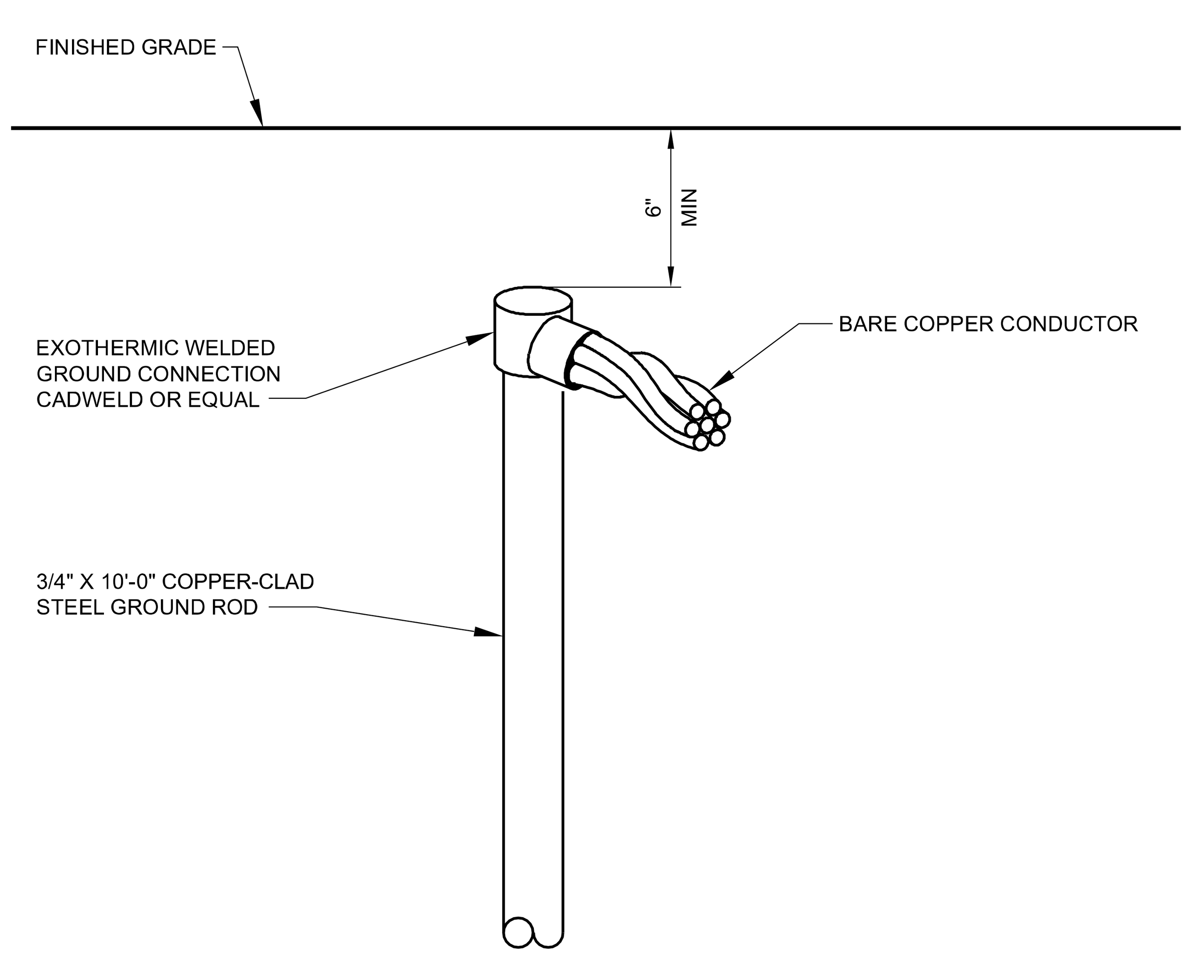
NO SCALE



NOTE:
CONCRETE ENCASEMENT OF DUCTBANK ONLY REQUIRED WHERE DUCTS INSTALLED UNDER ROADWAY CROSSINGS

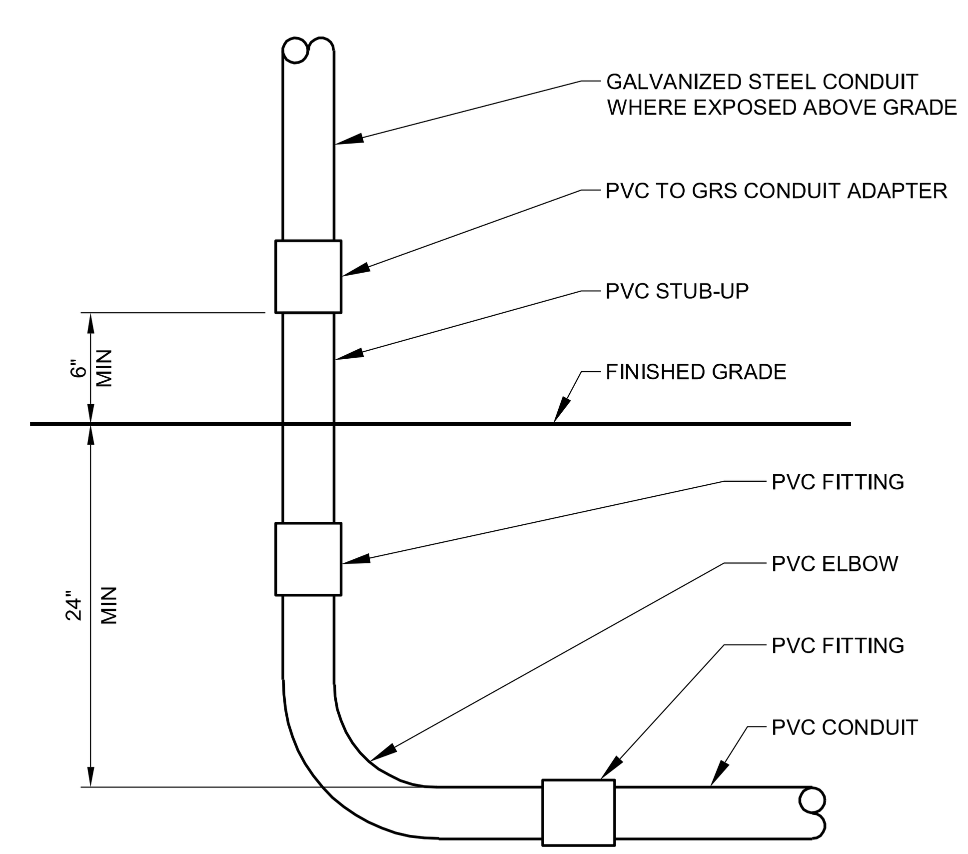
TYPICAL CONCRETE ENCASED DUCTBANK DETAIL

NO SCALE



TYPICAL GROUND ROD DETAIL

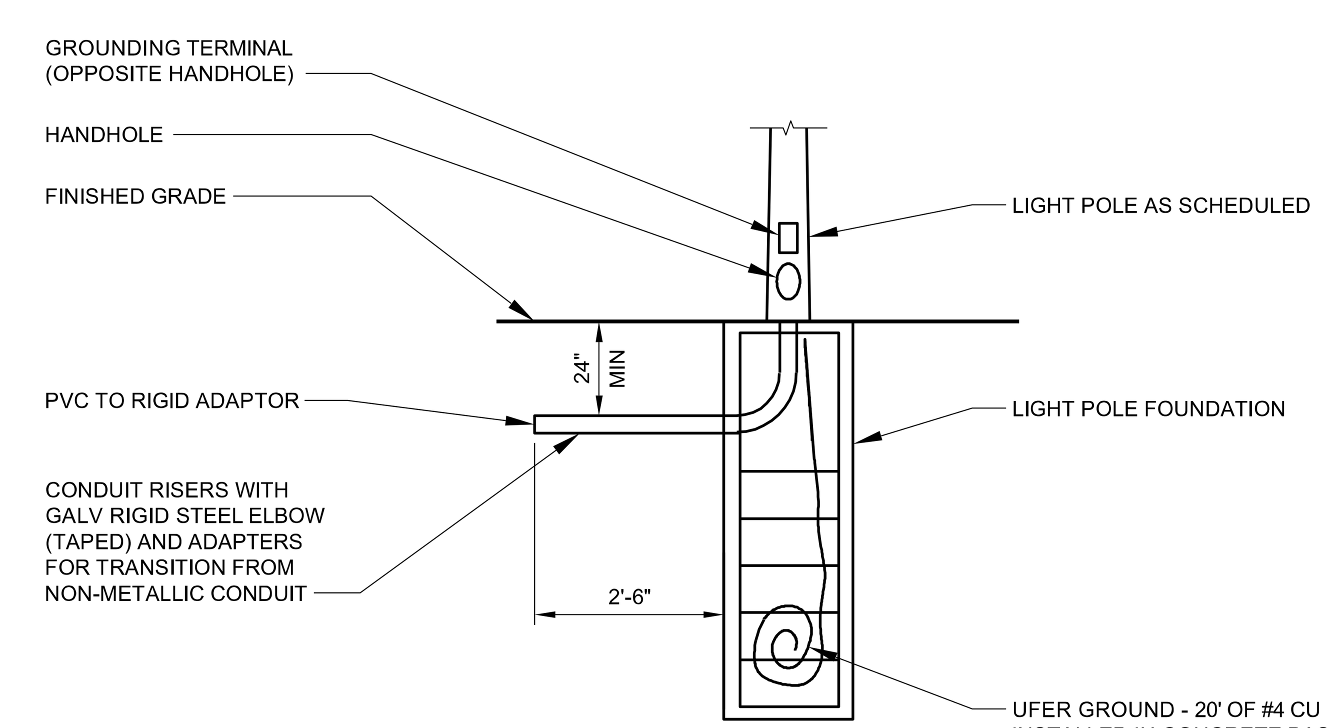
NO SCALE



NOTE:
WHERE CONDUITS ARE RUN IN SLAB, THE 24" DIMENSION DOES NOT APPLY.

TYPICAL CONDUIT STUB-UP DETAIL

NO SCALE



TYPICAL LIGHT POLE GROUNDING DETAIL

NO SCALE

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

DESIGNED BY: M.J. HILL
DRAWN BY: D.A. NELSON
CHECKED BY:
SUBMITTED BY:
SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
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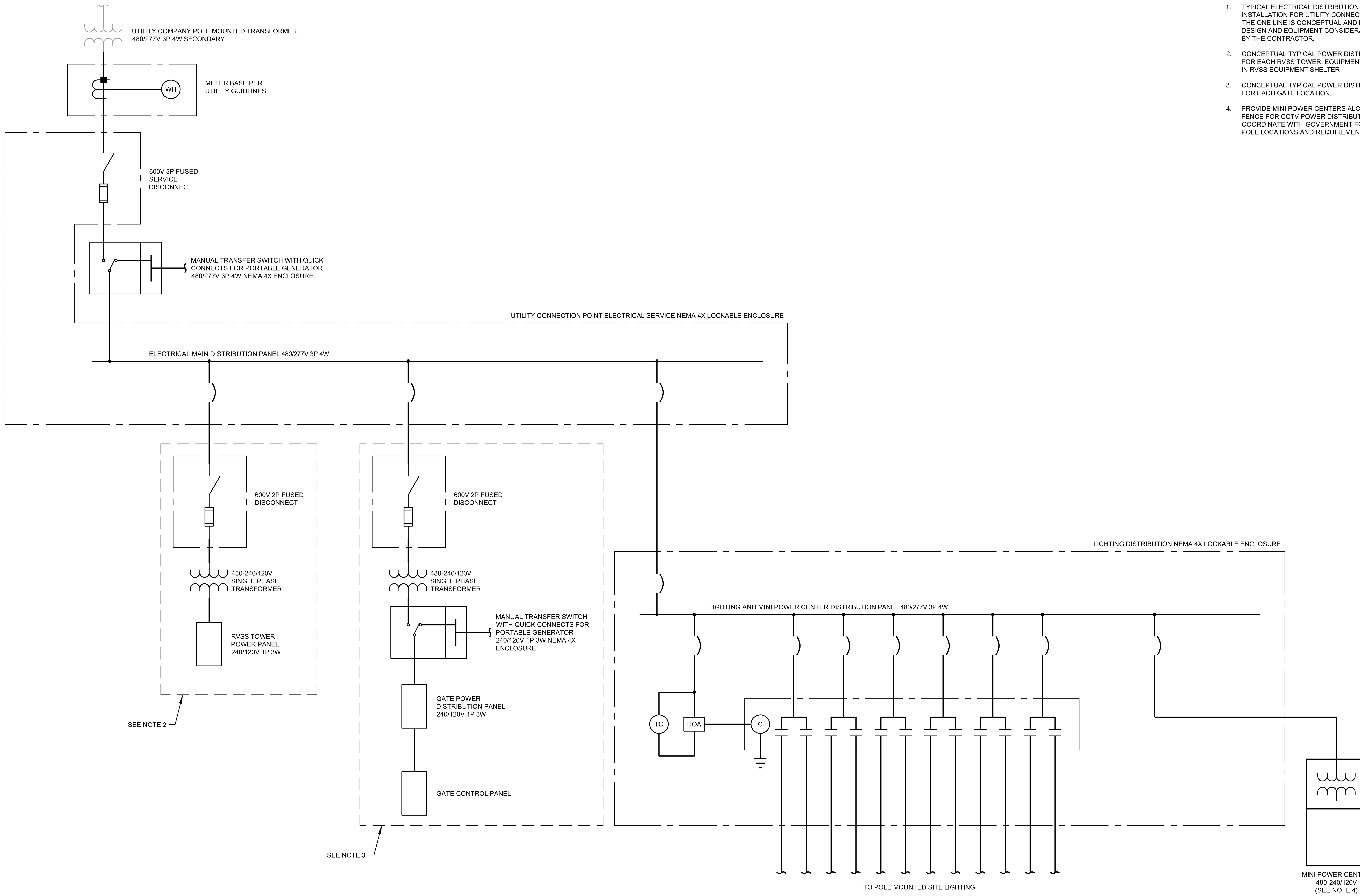
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE

ELECTRICAL DETAILS - SHEET 2
50 FEET SINGLE LEAF AUTOMATED GATE

SHEET ID
ROMA
E-504



NOTES:

1. TYPICAL ELECTRICAL DISTRIBUTION EQUIPMENT INSTALLATION FOR UTILITY CONNECTION POINT. THE ONE LINE IS CONCEPTUAL AND FINAL DESIGN AND EQUIPMENT CONSIDERATIONS ARE BY THE CONTRACTOR.
2. CONCEPTUAL TYPICAL POWER DISTRIBUTION FOR EACH RVSS TOWER. EQUIPMENT LOCATED IN RVSS EQUIPMENT SHELTER
3. CONCEPTUAL TYPICAL POWER DISTRIBUTION FOR EACH GATE LOCATION.
4. PROVIDE MINI POWER CENTERS ALONG THE FENCE FOR CCTV POWER DISTRIBUTION. COORDINATE WITH GOVERNMENT FOR LIGHT POLE LOCATIONS AND REQUIREMENTS.

CONCEPTUAL UTILITY SERVICE POINT ELECTRICAL ONE-LINE DIAGRAM

NO SCALE

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

DESIGNED BY: M.J. HILL
DRAWN BY: D.A. NELSON
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US ARMY CORPS OF ENGINEERS
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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BARRIER FENCE

CONCEPTUAL ONE-LINE DIAGRAM

SHEET ID
ROMA
E-601

Panel: PP

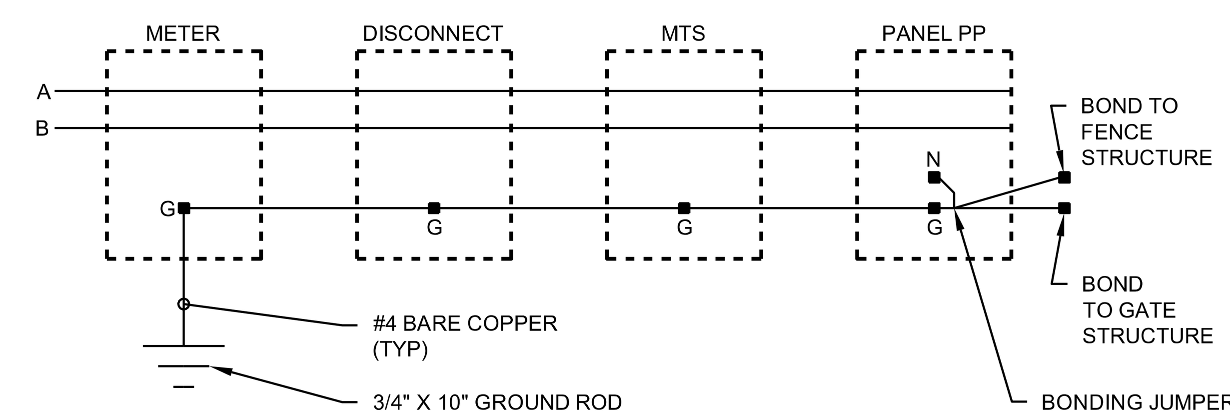
Location:		Volts:	240/120V	A.I.C Rating:	10,000
Supply From:	MTS	Phases:	1 P	Mains Type:	MCB
Mounting:	Surface	Wires:	3 Wire	Mains Rating:	200A
Enclosure:	NEMA 4X			MCB Rating:	200A

CKT	Circuit Description	Trip	Poles	A		B		Poles	Trip	Circuit Description	CKT
1	DOOR OPTR (7.5HP)	70A	2P	2460	0			2P	20A	SURGE SUPPRESSOR	2
3	-	-	-			2460	0	-	-	-	4
5	GFCI OUTLETS	20A	1P	180	400			1P	20A	SECURITY PANEL	6
7	LIGHTS	20A	1P			723	1000	1P	20A	SECURITY PANEL	8
9	LIGHTS	20A	1P	241	-			1P	20A	Spare	10
11	Spare	20A	1P			-	-	1P	20A	Spare	12
13	Spare	20A	1P	-	-			1P	20A	Spare	14
15	Spare	20A	1P			-	-	1P	20A	Spare	16
17	Spare	20A	1P					1P	20A	Spare	18
19	Spare	20A	1P			-	-	1P	20A	Spare	20
21	Spare	20A	1P	-	-			1P	20A	Spare	22
23	Spare	20A	1P			-	-	1P	20A	Spare	24
			Total Load:	3281	VA	4183	VA				
			Total Amps:	27.3	Amps	34.9	Amps				

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Power	1303	100%	1303	Total Conn. Load (VA):	7187
Lighting	964	125%	1205	Total Est. Demand (VA):	7428
Motor/HVAC	4920	100%	4920	Total Amps:	31.0

GATE ELECTRICAL PANEL SCHEDULE

NO SCALE



GATE GROUNDING DETAIL

NO SCALE

LUMINAIRE SCHEDULE										
TYPE	GENERAL DESCRIPTION	LIGHT SOURCE DATA				DRIVER/BALLAST		POWER DATA		NOTES
		LAMP TYPE	QTY x WATTS/LAMP	LAMP CODE/LED MODULE	LED DELIVERED LUMENS	CONTROL TYPE	DIMMING	SUPPLY VOLT	WATTS PER FIXT.	
	POLE MOUNTED LIGHT FIXTURE, 27FT POLE. REFERENCE SPECIFICATIONS FOR REQUIREMENTS FOR POLE, FIXTURE, AND ACCESSORIES	LED	BY CONTRACTOR	FURNISHED WITH FIXTURE	BY CONTRACTOR	NA	0-10V	480V	1200W MAX	

SITE LUMINAIRE SCHEDULE

NO SCALE

GENERAL NOTES

1. ALL ELECTRICAL EQUIPMENT SHALL BE RATED NEMA 4X
2. ALL ELECTRICAL EQUIPMENT SHALL BE RATED FOR 10KAIC MINIMUM.
3. ALL CONDUCTORS SHALL BE #12 AWG UNLESS NOTED OTHERWISE

CALCULATIONS

ASSUMPTIONS:

TRANSFORMER SIZE: 25kVA
IMPEDANCE: 1.58 Z (ESTIMATED)
UPSTREAM BUS CAPACITY: INFINATE
DISTANCE FROM TRANSFORMER: 50FT

SHORT CIRCUIT CURRENT:

IFL = (XFMR SIZE x 1000) / (VOLTAGE(LINE-LINE))

IFL = (25 x 1000) / (240) = 104.16A

IsC = IFL / %Z

IsC = (104.16A) / (.0158) = 6592 AMPS MAX

M = 1 / (1+F)

F = (2x(DISTANCE) x IsC) / ((CONSTANT) x (VOLTAGE))

F = (2 x 50FT x 6592A) / (13923 x 240) = 0.1972

M = 1 / (1 + 0.1972) = .8352

IsC(actual) = (6592 x 0.8352) = 5506A

PANEL BOARD MINIMUM
AIC = 10K AIC

ABBREVIATIONS

M = MULTIPLIER
F = FACTOR
IsC = SHORT CIRCUIT CURRENT

US Army Corps of Engineers ®

DATE | DESCRIPTION | MARK

ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

DESIGNED BY: M.J. HILL
DRAWN BY: D.A. NELSON
CHECKED BY:
SUBMITTED BY:
SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
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GALVESTON, TX 77553-1229

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DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BARRIER FENCE

ELECTRICAL SCHEDULES & DIAGRAMS
50 FEET SINGLE LEAF AUTOMATED GATE

SHEET ID
ROMA
E-602

SHEET NOTES

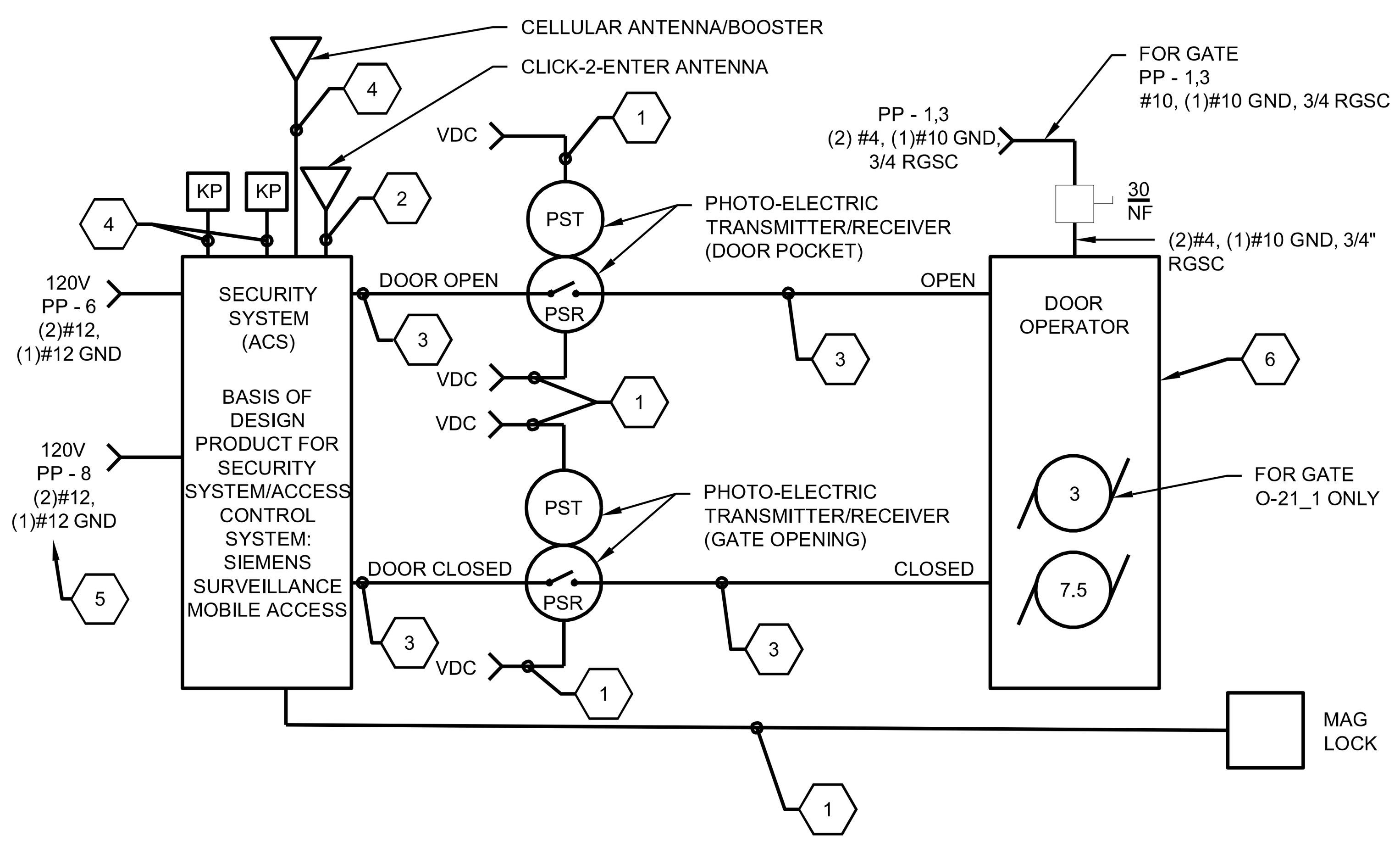
1. 2 #12 (POWER) FROM SECURITY PANEL
2. 2 #12 (POWER) + 2 #16 (DOOR OPEN SIGNAL)
3. 2 #16 (CONTROL)
4. SPECIALITY CABLE PER MANUFACTURER
5. POWER FOR CELLULAR ANTENNA BOOSTER. EXTEND CONDUCTORS/CONDUIT TO DEVICE LOCATION.
6. BASIS OF DESIGN PRODUCT FOR DOOR OPERATOR IS: DOOR KING 9575 W/ HEAVY DUTY HOUSING OPTION.
7. CONNECT TO ONE FIXTURE NEAREST TO PANELS (LANDSIDE)

LUMINAIRE SCHEDULE

TYPE	GENERAL DESCRIPTION	LIGHT SOURCE DATA				DRIVER/BALLAST		POWER DATA		MANUFACTURER AND CATALOG NUMBER SERIES	NOTES
		LAMP TYPE	QTY x WATTS/LAMP	LAMP CODE/LED MODULE	LED DELIVERED LUMENS	CONTROL TYPE	DIMMING	SUPPLY VOLT	WATTS PER FIXT.		
A	DSX1 LED P9 50K T5W MVOLT (LITHONIA LIGHTING)	LED	NA	FURNISHED WITH FIXTURE	28805	NA	0-10V	120V	241	DSX1 LED P9 50K T5W MVOLT (LITHONIA LIGHTING)	

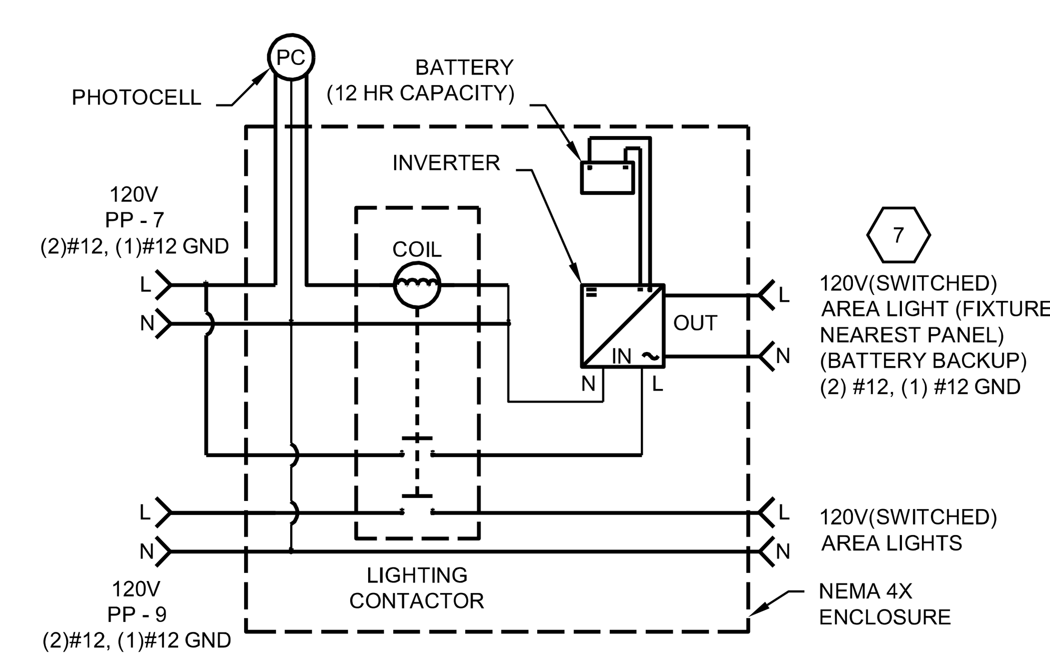
GATE LUMINAIRE SCHEDULE

NO SCALE



GATE CONTROL DIAGRAM

NO SCALE



GATE LIGHTING CONTACTOR DIAGRAM

NO SCALE

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MARK | DESCRIPTION | DATE

ISSUED DATE:
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CONTRACT NO.:
FILE NUMBER:

DESIGNED BY: M.J. HILL
DRAWN BY: D.A. NELSON
CHECKED BY:
SUBMITTED BY:
SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE
ELECTRICAL CONTROL SCHEMATIC
50 FT. SINGLE LEAF AUTOMATED GATE

SHEET ID
ROMA
E-603

US Army Corps of Engineers ®
GALVESTON DISTRICT

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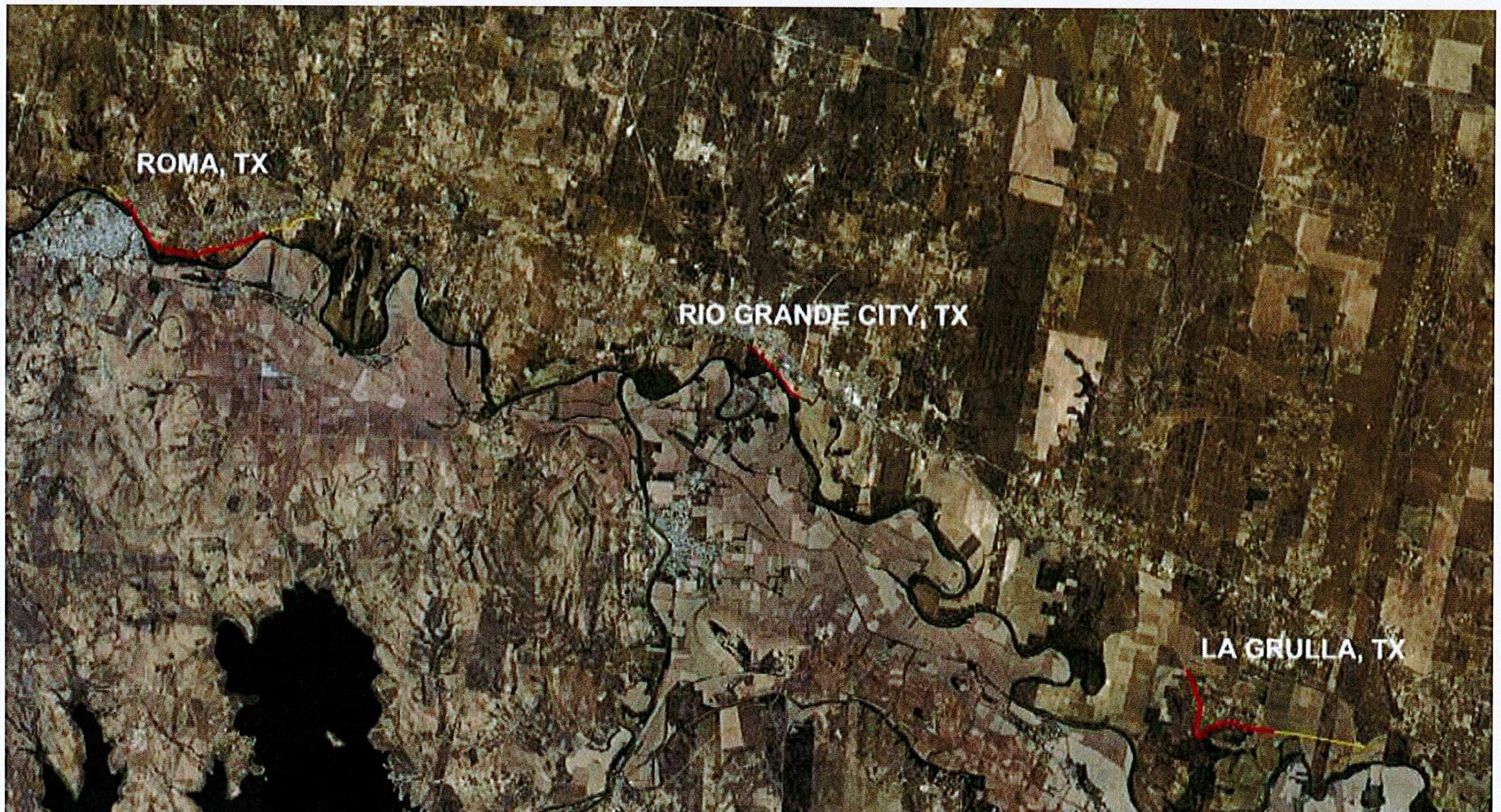
RGV 06 - BORDER INFRASTRUCTURE CONSTRUCTION PROJECT
RIO GRANDE VALLEY (RGV) CONSTRUCTION OF BOLLARD FENCE



RIO GRANDE CITY, TEXAS

SOLICITATION NO.:

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

DESIGNED BY:
DRAWN BY:
CHECKED BY:
SUBMITTED BY:
SIZE: ANSI D
ISSUED DATE:
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

US ARMY CORPS OF ENGINEERS
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RGV 06 - BORDER INFRASTRUCTURE CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV) CONSTRUCTION OF BOLLARD FENCE

PROJECT LOCATION

SHEET ID
RGC
G-000

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GALVESTON DISTRICT

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RGV 06 - BORDER INFRASTRUCTURE CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV) CONSTRUCTION OF BOLLARD FENCE RIO GRANDE CITY BASE

RIO GRANDE CITY, TEXAS

NORTH

SOLICITATION NO.:
CONTRACT NO.:
ISSUE DATE:

INDEX

DESIGN FILE	SHEET NO.	DESCRIPTION
G-CS-001.DWG	G-001	COVER SHEET
G-CS-002.DWG	G-002	LEGEND AND ABBREVIATIONS
G-LG-003.DWG	G-003	GENERAL NOTES
G-KP-004.DWG	G-004	KEYPLAN STA.10+00.00 - 86+80.00
G-CS-005.DWG	G-005	FENCE PI LOCATIONS
C-PP-101.DWG	C-101	PLAN & PROFILE 10+00.00 - 19+00.00
C-PP-102.DWG	C-102	PLAN & PROFILE 19+00.00 - 30+00.00
C-PP-103.DWG	C-103	PLAN & PROFILE 30+00.00 - 41+00.00
C-PP-104.DWG	C-104	PLAN & PROFILE 41+00.00 - 52+00.00
C-PP-105.DWG	C-105	PLAN & PROFILE 52+00.00 - 63+00.00
C-PP-106.DWG	C-106	PLAN & PROFILE 63+00.00 - 74+00.00
C-PP-107.DWG	C-107	PLAN & PROFILE 74+00.00 - 85+00.00
C-PP-108.DWG	C-108	PLAN & PROFILE 85+00.00 - 86+80.00
C-SC-301.DWG	C-301	TYPICAL CROSS SECTION
C-DT-501.DWG	C-501	ROAD CROSSING AND KEYPAD MOUNT DETAILS
S-FR-101.DWG	S-101	PLAN & ELEVATION - 20 FT GATE
S-FR-102.DWG	S-102	PLAN & ELEVATION - 50 FT GATE
S-FR-103.DWG	S-103	PLAN & ELEVATION - 50 FT GATE
S-DT-501.DWG	S-501	CONCRETE DETAILS
S-DT-502.DWG	S-502	STRUCTURAL DETAILS
S-DT-503.DWG	S-503	STRUCTURAL DETAILS
S-DT-504.DWG	S-504	WIRE MESH DETAILS
S-DT-505.DWG	S-505	FENCE DETAILS
S-DT-506.DWG	S-506	FENCE DETAILS
E-LG-001.DWG	E-001	LEGEND AND ABBREVIATIONS
E-LG-002.DWG	E-002	ELECTRICAL AND COMMUNICATION NOTES
E-CP-101.DWG	E-101	CONCEPTUAL OVERALL CAMERA CONDUIT INFRASTRUCTURE
E-EU-102.DWG	E-102	ELECTRICAL SINGLE GATE - PLAN VIEW
E-DT-501.DWG	E-501	CONDUIT ROUTING DETAILS
E-DT-502.DWG	E-502	RVSS TOWER YARD EQUIPMENT DETAILS
E-DT-503.DWG	E-503	ELECTRICAL DETAILS - SHEET 1
E-DT-504.DWG	E-504	ELECTRICAL DETAILS - SHEET 2
E-DG-601.DWG	E-601	CONCEPTUAL ONE-LINE DIAGRAM
E-DG-602.DWG	E-602	ELECTRICAL SCHEDULES AND DIAGRAMS
E.DG-603.DWG	E-603	ELECTRICAL CONTROL SCHEMATIC

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

DESIGNED BY: A.PONCHAI
DRAWN BY: A.PONCHAI
CHECKED BY: B.PRESTON
SUBMITTED BY: B.PRESTON
SIZE: ANSI D

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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

COVER SHEET

SHEET ID
RGC
G-001

1 2 3 4 5 6 7 8 9 10

GENERAL ABBREVIATIONS

NOTE: NOT ALL ABBREVIATIONS INDICTED MAY APPEAR ON THESE DRAWINGS

BOTTOM	BOT
CENTERLINE	CL
CORRUGATED METAL PIPE	CMP
COLUMN	COL
CONCRETE	CONC
DIAMETER	DIA
DOWEL	DWL
DRAWINGS	DWG(S)
EACH WAY	EW
ELEVATION	EL
ELECTRICAL	ELEC
EDGE OF PAVEMENT	EP
EXPANSION	EXP
FIRE HYDRANT	FH
FLOWLINE	FL
GALVANIZED	GALV
GATE VALVE	GV
GUTTER	G
HORSEPOWER	HP
HORIZONTAL	HORIZ
INSIDE DIAMETER	ID
IRON ROD	IR
LEFT	LT
MANHOLE	MH
MAXIMUM	MAX
MINIMUM	MIN
MISCELLANEOUS	MISC
NUMBER	#
NUMBER	NO
ON CENTER	OC
OUTSIDE DIAMETER	OD
PAVEMENT	PVMT
POINT OF CURVATURE	PC
POINT OF INTERSECTION	PI
POINT OF TANGENCY	PT
POLYVINYL CHLORIDE	PVC
RADIUS	R
REMOVE	REMOV
REINFORCING	REINF
REINFORCED CONCRETE PIPE	RCP
RIGHT	RT
RIGHT OF WAY	ROW
SANITARY	SAN
SCHEDULE	SCHED
SECTION	SECT
SILT FENCE	SF
STAINLESS STEEL	SS
STORM WATER POLLUTION PREVENTION	SWPP
SPECIFICATIONS	SPECS
STORM	STM
SEWER	SEW
TOP	T
TOP OF	T/
TYPICAL	TYP
UNLESS OTHERWISE NOTED	UON
VARIES	VAR
VERTICAL	VERT
WITH	W/
WELDED WIRE FABRIC	WWF

GENERAL SYMBOLS LIST

	BREAK LINE
	TREE LINE
Cx	OVERHEAD COMMUNICATION LINE
Cx	UNDERGROUND COMMUNICATION LINE
SDx	STORM DRAINAGE LINE
	WATER OR IRRIGATION LINE (24" & SMALLER LINE)
x	EXISTING BARBED WIRE FENCE
E E	EXISTING ELECTRIC (OVERHEAD)
E E	ELECTRIC (UNDERGROUND)
O	OIL OR PETROLEUM LINE
	TELEPHONE LINE
Wx	EXISTING WATER LINE
	SURVEY CONTROL MONUMENT
	SIGN
	DITCH
	DITCH CENTER LINE
	ROADWAY
RW	ENFORCEMENT ZONE LINE
	EDGE OF EXISTING ASPHALT
	FIRE HYDRANT
	DOWN GUY
	TELEPHONE/SIGNAL PULL BOX
	PROPERTY CORNER
	CULVERT
	PULL BOX FOR POWER/CONTROL
	PULL BOX FOR TELEPHONE/INSTRUMENTATION
	POSSIBLE KEY PAD LOCATION
	GATE PIER FOUNDATION
R.O.W.	RIGHT-OF-WAY
	TRAFFIC FLOW PATTERN
	EXISTING RETAINING WALL
	PROPOSED GATE
	EXISTING BORDER FENCE CORNER
31	EXISTING CONTOUR
34	PROPOSED CONTOUR
	PROPOSED BOLLARD FENCE
SF	SILT FENCE
MAIL	MAILBOX
GP	GUARD POST (BOLLARD)
	BOREHOLE
PP/XFMR	POWER POLE WITH TRANSFORMER
PIPE	VERTICAL PIPE
CDC	COMMUNICATION DROP CONNECTION
C-RISER	COMMUNICATION RISER
C-UNG	UNDERGROUND COMMUNICATION MARKER
CAM	SECURITY CAMERA
	UTILITY POLE
EDC	ELECTRIC DROP CONNECTION
	GROUND ROD
	LIGHT
	LIGHT POLE
XXX	ELECTRIC METER
	ELECTRIC PANEL
S	SWITCH
	JUNCTION BOX
WV	WATER VALVE
W	WATER METER
IV	IRRIGATION VALVE
	EVERGREEN TREE
	DECIDUOUS TREE
	ASPHALT ROADWAY
	CONCRETE
	AGGREGATE ROADWAY

US Army Corps of Engineers ®

MARK | DESCRIPTION | DATE

ISSUED DATE: | SOLICITATION NO.: | CONTRACT NO.: | FILE NUMBER:

DESIGNED BY: X | DRAWN BY: X | CHECKED BY: X | SUBMITTED BY: X | SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

LEGEND AND ABBREVIATIONS

SHEET ID
RGC
G-002

No.	Description	Station	Latitude	Longtitude
1	Base Start	10+00.00'	N26° 22' 27.43"	W98° 48' 44.97"
2	PI	12+49.47'	N26° 22' 27.67"	W98° 48' 42.24"
3	PI	14+12.20'	N26° 22' 26.72"	W98° 48' 40.80"
4	PI	23+92.91'	N26° 22' 20.45"	W98° 48' 32.56"
5	PI	36+14.30'	N26° 22' 12.13"	W98° 48' 22.82"
6	PI	41+63.60'	N26° 22' 08.14"	W98° 48' 18.70"
7	PI	44+85.60'	N26° 22' 06.02"	W98° 48' 16.06"
8	PI	47+26.31'	N26° 22' 05.34"	W98° 48' 13.53"
9	PI	48+30.31'	N26° 22' 04.80"	W98° 48' 12.55"
10	PI	49+42.31'	N26° 22' 03.91"	W98° 48' 11.82"
11	PI	50+30.31'	N26° 22' 03.08"	W98° 48' 11.53"
12	PI	51+54.23'	N26° 22' 02.07"	W98° 48' 10.75"
13	PI	52+39.44'	N26° 22' 01.53"	W98° 48' 10.03"
14	PI	54+16.63'	N26° 22' 00.28"	W98° 48' 08.67"
15	PI	55+23.43'	N26° 21' 59.31"	W98° 48' 08.19"
16	PI	56+65.98'	N26° 21' 58.19"	W98° 48' 07.24"
17	PI	59+27.04'	N26° 21' 56.48"	W98° 48' 05.09"
18	PI	61+80.52'	N26° 21' 54.67"	W98° 48' 03.15"
19	PI	64+98.66'	N26° 21' 52.11"	W98° 48' 01.12"
20	PI	66+68.05'	N26° 21' 50.54"	W98° 48' 00.44"
21	PI	68+79.71'	N26° 21' 49.14"	W98° 47' 58.72"
22	PI	78+07.80'	N26° 21' 41.34"	W98° 47' 53.32"
23	PI	78+66.75'	N26° 21' 40.94"	W98° 47' 52.84"
24	PI	81+61.21'	N26° 21' 39.68"	W98° 47' 49.92"
25	Base End	86+79.99'	N26° 21' 37.87"	W98° 47' 44.58"

E1 FENCE POB, EOP AND PI LOCATIONS
SCALE: NTS

US Army Corps of Engineers ®

MARK | DESCRIPTION | DATE

ISSUED DATE:
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

DESIGNED BY: X
DRAWN BY: X
CHECKED BY: X
SUBMITTED BY: X
SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

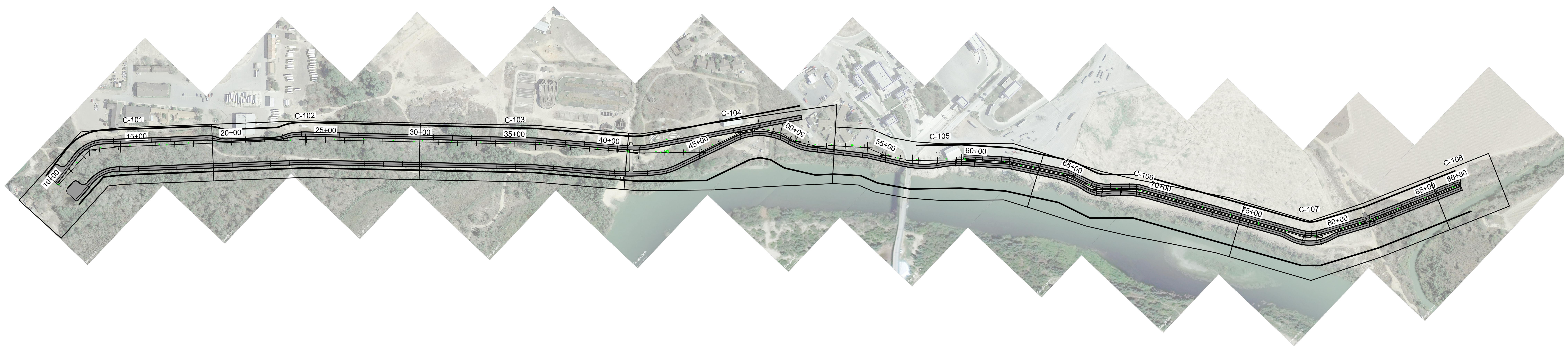
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

FENCE PI LOCATIONS
STA. 10+00.00 - 86+38.00

SHEET ID
RGC
G-005

1 2 3 4 5 6 7 8 9 10

G F E D C B A



A1 KEYPLAN
SCALE: 1" = 300'-0"

0 300 600 1' = 300' - 0"

US Army Corps of Engineers ®

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RGV 06 - BORDER INFRASTRUCTURE
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KEYPLAN
STA. 10+00.00 - 85+34.00

SHEET ID
RGC
G-004

1 2 3 4 5 6 7 8 9 10

GENERAL:

1. ANY AND ALL DAMAGE TO EXISTING ROADS, CONCRETE LINED DITCH, FENCE UTILITIES AND ALL OTHER EXISTING STRUCTURES RESULTING FROM THE CONTRACTOR'S CONSTRUCTION SHALL BE REPLACED AND REPAIRED TO ORIGINAL CONDITION OR BETTER AND TO THE SATISFACTION OF THE COR AT THE EXPENSE OF THE CONTRACTOR.

2. IF MATERIALS, QUANTITIES, STRENGTHS OR SIZES INDICATED BY THE DRAWING OR SPECIFICATIONS ARE NOT IN AGREEMENT WITH THESE NOTES, THE BETTER QUALITY AND / OR GREATER QUANTITY. STRENGTH OR SIZE INDICATED, SPECIFIED, OR NOTED SHALL BE PROVIDED.

3. IT IS SOLELY THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE ERECTION PROCEDURE AND SEQUENCE TO INSURE THE SAFETY OF THE STRUCTURE AND ITS COMPONENT PARTS DURING ERECTION. THIS INCLUDES, BUT NOT LIMITED TO,THE ADDITION OF WHATEVER TEMPORARY BRACING, SHORING, GUYS OR TIE-DOWNS THAT MAY BE NECESSARY. SUCH MATERIAL SHALL BE REMOVED AND SHALL REMAIN THE PROPERTY OF THE CONTRACTOR AFTER COMPLETION OF THE PROJECT.

4. THE CONTRACTOR , AT HIS OWN EXPENSE, SHALL RESPOND TO COMPLAINTS REGARDING DUST AND NOISE POLLUTION RESULTING FROM HIS WORK.

5. THE CONTRACTOR SHALL PROVIDE SAFE ACCESS TO AND FROM ALL DRIVEWAYS AND STREETS, PAVED OR UNPAVED, AT ALL TIMES DURING CONSTRUCTION.

6. THE CONTRACTOR SHALL VERIFY AND CHECK ALL DIMENSIONS, LOCATIONS, ELEVATIONS AND DETAILS SHOWN ON THESE DRAWINGS PRIOR TO START OF CONSTRUCTION. ANY UNCERTAINTIES AND DISCREPANCIES SHALL BE IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE CONTRACTING OFFICER FOR CLARIFICATION PRIOR TO COMMENCING THAT WORK FEATURE..

7. THE PROJECT SHALL BE SECURED AT ALL TIMES DURING CONSTRUCTION.

8. THE CONTRACTOR SHALL DISPOSE OF ALL CONSTRUCTION DEBRIS AND OTHER WASTE MATERIAL OFF THE GOVERNMENT OWNED LAND AT AN APPROVED OFF-SITE DISPOSAL AREA IN ACCORDANCE WITH APPLICABLE REGULATORY AGENCY REQUIREMENTS. ALL PERMITS REQUIRED FOR OFF-SITE DISPOSAL SHALL BE OBTAINED BY THE CONTRACTOR.

9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COMPLIANCE WITH AND THE ENFORCEMENT OF ALL APPLICABLE SAFETY REGULATIONS. ACCORDING TO EM 385-1-1 SAFETY AND HEALTH REQUIREMENTS MANUAL.

10. IN CASE OF DISCREPANCY BETWEEN THE SPECIFICATIONS AND CONSTRUCTION DOCUMENTS, THE MORE STRINGENT SHALL APPLY.

11. DURING CONSTRUCTION, STRUCTURE MAY BE BUOYANT. IN THE EVENT OF FAILURE OF DEWATERING SYSTEM AND THE EXCAVATION BECOMES FLOODED OR THE SURROUNDING GROUND BECOMES SATURATED. THE CONTRACTOR SHALL SUBMIT A PLAN TO PREVENT FLOATING OF THE STRUCTURE.

12. ALL WORK SHALL BE COMPLETED TO THE SATISFACTION OF THE USACE, DHS AND USIBWC.

13. THE CONTRACTOR SHALL PRESERVE AND PROTECT OR REMOVE (WITH PRIOR WRITTEN APPROVAL OF AFFECTED PROPERTY OWNER'S) ALL TREES, SHRUBS, HEDGES, RETAINING WALLS. LANDSCAPING, BUILDINGS, WALKS,ETC..., IN OR NEAR CONSTRUCTION AREA. CONTRACTORS SHALL TRIM AND / OR CUT AS NECESSARY ANY TREE OR BRANCH WITHIN OR EXTENDING INTO THE ENFORCEMENT ZONE IN ORDER TO PROVIDE A CLEAR ZONE.

14. INTERMITTENT SURVEY MONUMENTS MAY BE UNCOVERED DURING FENCE REMOVAL THAT ARE NOT SHOWN ON THE PLANS. THESE MONUMENTS SHALL BE PROTECTED IN PLACE. REALIGN FENCE AROUND MONUMENT TO CLEAR CONCRETE MONUMENT FOOTING (3 FEET OFFSET NOT REQUIRED).

15. THE CONTRACTOR SHALL NOT HAVE CONTACT WITH PRIVATE PROPERTY OWNERS WITHOUT SPECIFIC APPROVAL FROM USACE AND CBP. THE CONTRACTOR SHALL COORDINATE WITH PRIVATE LANDOWNERS TO MAINTAIN ACCESS TO PRIVATE PROPERTY DURING CONSTRUCTION. RIGHT OF ENTRY WILL BE PROVIDED AT CONTRACT AWARD.

16. CONTRACTOR MAXIMUM SPEED THROUGH THE CONSTRUCTION FOR BORDER PATROL MUST ALWAYS BE ALLOWED.

17. UNOBSTRUCTED ACCESS THROUGH THE CONSTRUCTION FOR BORDER PATROL MUST ALWAYS BE ALLOWED.

18. CONTRACTOR SHALL HIRE A PROFESSIONAL GEOTECHNICAL ENGINEER TO PROVIDE INSPECTION OF EXCAVATIONS AND SOIL/GROUNDWATER CONDITIONS THROUGHOUT CONSTRUCTION. THE GEOTECHNICAL ENGINEER IS RESPONSIBLE FOR PERFORMING PRE-CONSTRUCTION AND PERIODIC SITE VISITS THROUGHOUT CONSTRUCTION TO ASSESS THE SITE CONDITIONS. ALL COMMUNICATION WITH THE CONTRACTOR WILL BE COORDINATED WITH AND THROUGH THE CONTRACTING OFFICER OR COR TO CHANGE OR CLARIFY THE CONTRACT DOCUMENTS. THE CONTRACTOR WILL BE REQUIRED TO PROVIDE 24-HOUR ADVANCE NOTICE TO THE COR AS WELL AS A WRITTEN SUMMARY REPORT TO COR, WITH REGARD TO ANY SITE VISIT THAT IS COMPLETED BY THE CONTRACTOR'S GEOTECHNICAL ENGINEER.

19. ALL UTILITIES LOCATIONS ARE APPROXIMATE AND TO BE VERIFIED BY THE CONTRACTOR. IT IS THE CONTRACTOR'S RESPONSIBILITY TO IDENTIFY AND LOCATE ALL EXISTING UNDERGROUND AND OVERHEAD UTILITIES PRIOR TO THE START OF DESIGN CONSTRUCTION.

20. CONTRACTOR SHALL MAINTAIN ALL BARBED WIRE FENCES STANDING AT ALL TIMES AND SHALL REPAIR OR REPLACE IF DAMAGED AT CONTRACTOR'S EXPENSE. CONTRACTOR SHALL CLOSE ALL OPEN AREAS WHERE FENCE IS REMOVED WITH BARBED WIRE TO PREVENT CATTLE CROSSING ON THE BORDER. CONTRACTOR SHALL GUARANTEE THAT NO CATTLE WILL CROSS INTO THE US DURING CONSTRUCTION.

21. ALL BORDER MONUMENTS SHALL BE PROTECTED IN PLACE.

22. DESIGN LOADS
WIND LOAD:

-	BASIC WIND SPEED	116 MPH
-	EXPOSURE	C

EARTHQUAKE DESIGN DATA

-	SPECTRAL RESPONSE ACCELERATION. Ss	0.044
-	SPECTRAL RESPONSE ACCELERATION. S1	0.013
-	SITE CLASS	D
-	SPECTRAL RESPONSE ACCELERATION. SDS	0.044
-	SPECTRAL RESPONSE COEFFICIENT. SD1	0.023
-	SEISMIC DESIGN CATEGORY. SD1	A

23. THE CONTRACTOR'S TRAFFIC CONTROL PLAN SHALL CONFORM TO THE MORE STRINGENT REQUIREMENT(S) OF TXDOT AND EM385-1-1 REQUIREMENTS.

DEMOLITION AND STRUCTURAL STEEL REMOVAL:

1. THE CONTRACTOR SHALL REMOVE AND DISPOSE OF ALL ITEMS CALLED FOR IN THE PLANS AT AN APPROVED OFF-SITE LOCATION.

2. SEE SECTION 02 41 00 DEMOLITION FOR ADDITIONAL INFORMATION.

3. AT SEVERAL LOCATIONS, ITEMS, SUCH AS BUT NOT LIMITED TO TRAFFIC SIGNS AND MEMORIAL ITEMS, ARE ATTACHED TO THE EXISTING FENCING. IF SUCH ITEMS ARE NOT REMOVED BY LOCAL AUTHORITIES PRIOR TO FENCE DEMOLITION CONTRACTOR SHALL REMOVE SUCH ITEMS AND TURN THEM OVER TO THE COR.

4. AT ALL WASHES, WASH NUMBER SIGNS THAT ARE WELDED TO EXISTING FENCING SHALL BE REMOVED AND TURNED OVER TO COR TO GIVE BORDER PATROL. CONTRACTOR SHALL COORDINATE THROUGH COR WITH BORDER PATROL TO PLACE BACK ONTO NEW FENCE.

CLEARING AND GRUBBING:

1. PRIOR TO GENERAL SITE GRADING, AREAS TO RECEIVE NEW STRUCTURES SHALL BE STRIPPED OF ANY EXISTING STRUCTURES AND VEGETATION.

2. CONTRACTOR SHALL BE RESPONSIBLE FOR TRIMMING AND REMOVAL OF TREE OBSTRUCTING FENCE REPLACEMENT. FOR TREES ROOTED IN MEXICO THAT REQUIRE TRIMMING, CONTRACTOR SHALL COORDINATE WITH THE COR PRIOR TO CONDUCTING WORK.

3. WASTE MATERIALS INCLUDING VEGETATION, ROOTS, CONCRETE, SLURRY AND DEBRIS SHALL BE DISPOSED OF OFF-SITE BY CONTRACTOR.

EXISTING UTILITIES:

1. LOCATIONS OF UNDERGROUND UTILITIES ARE FROM BEST INFORMATION AVAILABLE AT THE TIME THESE PLANS WERE PREPARED. THE GOVERNMENT DOES NOT WARRANT THE ACCURACY OF THE INFORMATION AVAILABLE AT THE TIME THESE PLANS WERE PREPARED. THE GOVERNMENT DOES NOT WARRANT THE ACCURACY OF THE INFORMATION PROVIDED. ANY DEVIATION SHALL BE CALLED TO THE ATTENTION OF THE COR PRIOR TO PROCEEDING WITH WORK IN THE AREA OF FOUND UTILITIES.

2. APPROXIMATE LOCATIONS OF KNOWN EXISTING UTILITIES ARE SHOWN. CONTRACTOR SHALL DETERMINE THE EXACT HORIZONTAL AND VERTICAL LOCATIONS IN THE FIELD PRIOR TO COMMENCING WORK. CONTRACTOR TO BE FULLY RESPONSIBLE FOR DAMAGES WHICH MIGHT OCCUR BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE EXISTING UTILITIES AND /OR STRUCTURES.

3. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO HAVE ALL UTILITIES LOCATED AND MARKED PRIOR TO THE START OF CONSTRUCTION. ANY FOUND UTILITIES NOT STATED ABOVE SHALL BE BROUGHT TO THE ATTENTION OF THE COR FOR DIRECTION. PRIOR TO PROCEEDING WITH CONSTRUCTION IN THE AREA OF SAID UTILITIES.

4. PUBLIC AND PRIVATE UTILITY LINES AND CUSTOMER SERVICE LINES MAY EXIST THAT ARE NOT SHOWN ON THE CONSTRUCTION DRAWINGS. IT SHALL BE CONTRACTOR'S RESPONSIBILITY TO LOCATE, MAINTAIN AND PROTECT THE INTEGRITY OF THESE LINES. HAND EXCAVATION MAY BE REQUIRED.

5. CONTRACTOR SHALL COORDINATE WITH THE APPROPRIATE UTILITY COMPANY TO RELOCATE OR DIVERT ANY UTILITY IN CONFLICT WITH PROPOSED CONSTRUCTION SO AS NOT TO DISRUPT SERVICE OF IT. CONTRACTOR SHALL RESTORE, RELOCATED OR DIVERT UTILITY TO ITS ORIGINAL CONDITION AND LOCATION WHEN APPLICABLE UPON COMPLETION OF CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO MAKE ALL UTILITY ADJUSTMENTS AND ACQUIRE ALL REQUIRED PERMITS FOR RELOCATION.

6. THE VERIFIED LOCATIONS OF ALL UTILITIES SHALL BE DEPICTED ON THE WORKING RECORD DRAWINGS AND FINAL AS-BUILT DRAWINGS.

7. CONTACT THE CITY OF RIOGRANDE CITY ,CYNTHIA ESCAMILLA, PUBLIC UTILITY OPERATIONS MANAGER, (956) 487-0672 FOR UTILITY LOCATES WITHIN THE LIMITS OF CONSTRUCTION.

DRAINAGE:

6. CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ADEQUATE DRAINAGE AT ALL TIMES DURING CONSTRUCTION OF PROPOSED FACILITIES.

7. CONTRACTOR SHALL PROVIDE POSITIVE DRAINAGE AT ALL TIMES DURING THE INSTALLATION OF THE STRUCTURES AND DRAINAGE IMPROVEMENTS.

SWPPP:

1. IMPLEMENT SWPPP AS REQUIRED BY TCEQ REQUIREMENTS AND PROJECT SPECIFICATIONS PRIOR TO CONSTRUCTION IMPLEMENT BEST MANAGEMENT PRACTICES (BMPS) DESCRIBED IN THE SWPPP TO REDUCE EROSION. SEE SECTION 01 57 19 ENVIRONMENTAL CONTROLS.

2. THE CONTRACTOR SHALL ENSURE THAT BMPS ARE IN PLACE PRIOR TO AND DURING CONSTRUCTION OF THE FENCE. THE CONTRACTOR IS RESPONSIBLE TO ENSURE THAT EROSION AND SEDIMENT CONTROL MEASURES COMPLY WITH FEDERAL, STATE AND LOCAL REGULATIONS.

3. THE CONTRACTOR SHALL PROVIDE ONE SWPPP REPORT AND PLANS FOR CONSTRUCTION OF THE BASE BID AND OPTION ITEMS. PRIOR TO START OF CONSTRUCTION, THE CONTRACTOR SHALL OBTAIN A NOTICE OF INTENT AND COMPLETE THE NOTICE OF ENDING UPON COMPLETION.

4. THE COR RESERVES THE RIGHT TO REQUIRE THE CONTRACTOR TO MODIFY OR REVISE THE SWPPP TO ENSURE THAT ALL CURRENT MEASURES TO PREVENT OFF-SITE MIGRATION OF POLLUTANTS, INCLUDING SOILS, ARE INCLUDED IN THE SWPPP. IF SWPPP DOES NOT ADEQUATELY ADDRESS APPLICABLE BMPS OR IF THE CONTRACTING OFFICER DETERMINES THAT THE STORM WATER POLLUTION PREVENTION REQUIREMENTS ARE NOT BEING MET.

TUNNELS:

1. IN THE EVENT THAT AN UNDERGROUND TUNNEL OR VOID IS DISCOVERED DURING EXCAVATION, THE DESIGN - BUILD CONTRACTOR SHALL IMMEDIATELY CONTACT THE COR AND BORDER PATROL. THE DESIGN - BUILD CONTRACTOR SHALL INCLUDE THE LOCATION(S) AND DIMENSIONS OF ANY TUNNELS DISCOVERED ON BOTH THE WORKING RECORD DRAWINGS AND FINAL AS-BUILT DRAWINGS.

2. THE LOCATIONS OF ALL TUNNELS DISCOVERED SHALL BE DEPICTED ON THE WORKING RECORD DRAWINGS AND FINAL AS-BUILT DRAWINGS.

SEDIMENT CONTROL:

1. CONTRACTOR SHALL PROVIDE AND MAINTAIN SEDIMENT CONTROL SERVICES IN ACCORDANCE WITH THE CONTRACT DOCUMENT THROUGH THE TERM OF THE WORK COVERED BY HIS CONTRACT. SEE SECTION 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

ON-SITE FILL:

1. SOIL EXCAVATED FROM THE PROJECT SITE SHALL BE CONSIDERED ON -SITE FILL.

2. ON-SITE FILL REQUIRED TO BRING THE SITE TO GRADE SHALL BE FREE OF VEGETATION AND DEBRIS, AND CONTAIN NO ROCKS OR LUMPS LARGER THAN 3 INCH NOMINAL DIAMETER.

3. EXCAVATED ON-SITE SOILS MEETINGS THE REQUIREMENTS FOR ENGINEERED FILL MAY BE REUSED AS ENGINEERED FILL.

4. EXCAVATED ON-SITE SOILS NOT MEETING THE REQUIREMENTS FOR ENGINEERED FILL MAY BE REUSED FOR FILL WITHIN THE ENFORCEMENT ZONE TO ADJUST GRADE PROVIDED IT DOES NOT CONTAIN ROOTS, ORGANICS, TRASH, DELETERIOUS, UNSUITABLE OR UNSATISFACTORY MATERIAL AS DEFINED BY USIBWC LEVEE CONSTRUCTION GUIDELINES, AND SECTION 31 00 00 EARTHWORK PLAN SPECIFICATIONS, INCLUDING COHESIONLESS MATERIAL (SP SW SM GC GM GP GW)

5. EXCAVATED ON-SITE SOILS NOT MEETING THE REQUIREMENTS FOR ENGINEERED FILL MAY BE MODIFIED / CONDITIONED EITHER THROUGH LIME STABILIZATION OR BLENDING TO MEET THE REQUIREMENTS FOR ENGINEERED FILL AND USED WITHIN THE PROJECT SITE PROVIDED IT DOES NOT CONTAIN ROOTS, ORGANICS, DELETERIOUS OR UNSATISFACTORY MATERIALS AS DEFINED BY USIBWC LEVEE CONSTRUCTION GUIDELINES AND SECTION 31 00 00 EARTHWORK PLAN SPECIFICATIONS. ITS IS ESTIMATED 4% HYDRATED LIME WILL BE REQUIRED TO RAISE THE PH AND CONDITION ON-SITE-HIGH PLASTICITY CLAYS. TESTING WILL BE REQUIRED DURING CONSTRUCTION TO VALIDATE THE ESTIMATE. THE CONTRACTOR SHOULD BE AWARE THAT SOIL PROPERTIES VARY WITHIN THE PROJECT SITE, AND THE QUANTITY OF LIME ESTIMATED TO CONDITION THE ON-SITE SOILS MAY CHANGE.

6. EXISTING CALICHES /AGGREGATE SURFACE COURSE EXCAVATED FROM THE EXISTING ROAD MAY NOT BE REUSED AS AGGREGATE SURFACE COURSE FOR THE NEW PATROL ROAD OR CREST ROAD. EXISTING CALICHE/AGGREGATE SURFACE COURSE MAY BE REUSED AS FILL WITHIN THE ENFORCEMENT ZONE,OR USED AS SUBBASE MATERIAL WITHIN THE PATROL ROAD TO REDUCE THE AGGREGATE SURFACE MATERIAL WITHIN THE PATROL ROAD TO REDUCE THE AGGREGATE SURFACE COURSE REQUIREMENTS. SEE ALL WEATHER ROAD (SEE CIVIL NARRITIVE), PROVIDED IT DOES NOT CONTAIN ROOTS, ORGANICS, DELETERIOUS OR UNSATISFACTORY MATERIAL AS DEFINED BY USIBWC LEVEE CONSTRUCTION GUIDELINES, AND SECTION 31 00 00 EARTHWORK PLAN SPECIFICATIONS.

7. NO ON-SITE FILL SHALL BE PLACED ON OR AGAINST CONCRETE LESS THAN 7 DAYS AFTER PLACEMENT OR 70 PERCENT OF THE DESIGN STRENGTH WITHOUT PRIOR APPROVAL OF THE CONTRACTING OFFICER. CRAWLER-TYPE TRACTORS,VIBRATORY EQUIPMENT AND OTHER SIMILAR COMPACTION EQUIPMENT SHALL NOT BE USED WITHIN 4 FEET OF ANY COMPLETED OR PARTIALLY COMPLETED STRUCTURE. COMPACTION WITHIN 4 FEET OF COMPLETED OR PARTIALLY COMPLETED STRUCTURES SHALL BE ACCOMPLISHED BY THE USE OF MECHANICAL HAND TAMPERS, VIBRATING PLATES, OR OTHER APPROVED METHODS AND EQUIPMENT. FILL MATERIAL SHALL BE COMPACTED TO AT LEAST 95% OF THE MAXIMUM DRY DENSITY WITHIN ±3% OF THE OPTIMUM MOISTURE CONTENT IN ACCORDANCE WITH ASTM D 698. CONTRACTOR WILL ENSURE THAT COMPACTION OPERATIONS DO NOT DAMAGE ANY EXISTING UTILITIES OR STRUCTURE. ANY DAMAGE CAUSED BY THE CONTRACTOR'S OPERATION SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE..

8. FILL PLACED ON ENGINEERED FILL OR NATURAL SLOPES STEEPER THAN 5H:1V SHALL BE KEYED AND BENCHED INTO EXISTING SLOPE. THE BENCHES SHALL BE WIDE ENOUGH TO ACCOMMODATE THE COMPACTION EQUIPMENT AND THE LOWEST BENCH SHALL BE THE WIDEST AT A MINIMUM OF 8 TO 10 FEET WIDE. BENCH HEIGHTS SHALL BE A MAXIMUM OF 3 FEET. BENCH WIDTHS AT THE TOP SHALL BE A MINIMUM OF 4 FEET.

EGRESS/INGRESS ROAD AND STAGING AREAS:

1. THE CONTRACTOR MAY USE THE PUBLIC ROADS SHOWN ON THE LOCATION MAP IN THE PLANS FOR INGRESS / EGRESS TO THE PROJECT SITE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING ANY DAMAGE AT THESE LOCATIONS DUE TO CONSTRUCTION.

2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROCURING AND MAINTAINING THE STAGING AREA.

3. SAFE ACCESS THROUGH WORK SITE SHALL BE MAINTAINED AT ALL TIMES. MATERIAL AND EQUIPMENT SHALL NOT BE STAGED SUCH AS TO LIMIT ACCESS THROUGH THE CONSTRUCTION SITE.

4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROCURING AND MAINTAINING THE STOCKPILE AREA. STOCKPILE AREA WILL BE LOCKED OUTSIDE THE FLOOD PLAIN.

5. THE CONTRACTOR SHALL NOT HAVE CONTACT WITH PRIVATE PROPERTY OWNERS FOR EGRESS/INGRESS ACCESS WITHOUT SPECIFIC APPROVAL FROM USACE AND CBP.

EXCAVATION:

1. ALL EXCAVATED MATERIAL IS TO BE REMOVED FROM THE PROJECT PERMANENT EASEMENTS AND STAGING AREAS AND DISPOSES OF AT AN APPROVED DISPOSAL LOCATION. UNLESS OTHERWISE NOTED OR APPROVED FOR USE AS BACK FILL MATERIAL. EXCAVATED MATERIAL SHALL NOT BE STORED IN THE RIVER FLOOD PLAIN.

2. TRUCKS SHALL BE LOADED IN A MANNER SO AS TO AVOID LOSS OF LOADED MATERIAL OR ANY PORTION THEREOF DURING TRANSPORT IN ACCORDANCE WITH STATE LAW.

3. THE CONTRACTOR SHALL, AT HIS/HER OWN EXPENSE, REPAIR ANY HAUL ROAD SURFACE IRREGULARITIES CAUSES BY LOADING OR HAULING OPERATIONS.

4. ALL TEMPORARY EXCAVATIONS MUST COMPLY WITH APPLICABLE LOCAL, STATE AND FEDERAL SAFETY REGULATION.

PREPARED SUBGRADE:

1. DUE TO THE VARIABILITY OF SITE SOILS, ISOLATED AREAS OF THE SUBGRADE MAY REQUIRE OVER-EXCAVATION AND RECOMPACTION TO MITIGATE LOOSE OR DISTURBED SOIL CONDITIONS. SUBGRADE FOR THE ENTIRE BORDER ROAD SHALL BE PROOF ROLLED IN ACCORDANCE WITH SECTION 31 00 00 EARTHWORK, SUBSECTION 3.12.1 PROOF ROLLING. ANY AREAS OBSERVED TO DEFLECT UNDER THE PRESSURE EXERTED BY THE PROOF ROLLING OPERATIONS WILL REQUIRE OVER-EXCAVATION AND REPLACEMENT WITH ENGINEERED FILL.

2. FOR CUT AREAS, CUT PROPOSED ROAD TO GRADE, SCARIFY TOP 8 INCHES OF SUBGRADE AND MOISTURE CONDITION. FOR FILL AREAS, SCARIFY TOP 6 INCHES OF EXISTING GRADE AND MOISTURE AND CONDITION.

3. COMPACT SUBGRADE FOR CUTTING AREAS TO 95% OF ASTM D1557 AT ±2% OF OPTIMUM MOISTURE CONTENT. FILL MATERIAL SHALL BE TESTED IN 8-INCH LOOSE/ COMPACTED TO 6 INCHES UNDER ROADWAYS AND 12-INCH LOOSE/COMPACTED TO 8-INCHES IN OTHER FILL LOCATIONS AND SHALL CARRY SIMILAR SOIL PROPERTIES AS SHOWN ON BORING LOGS. COMPACTION OF FILL MATERIAL IN SUBGRADE SHALL BE TO 95% OF ASTM D1557 AT ±2% OF OPTIMUM MOISTURE CONTENT.

4. SITE GRADING PERFORMED DURING OR SUBSEQUENT TO WET WEATHER MAY RESULT IN NEAR-SURFACE SITE SOILS WITH MOISTURE CONTENTS SIGNIFICANTLY ABOVE OPTIMUM. THIS CONDITION COULD HAMPER EQUIPMENT MANEUVERABILITY AND EFFORTS TO COMPACT SITE SOILS TO THE RECOMMENDED COMPACTION CRITERIA. DURING MOST OF THE YEAR, THE SITE WILL TYPICALLY DRY TO WORKABLE MOISTURE CONTENTS WITHIN 1 TO 2 DAYS. IF TIME IS CRITICAL FACTOR. DISKING FOR AERATION, CHEMICAL TREATMENT, REPLACEMENT WITH DRIER MATERIAL, STABILIZATION WITH GEOTEXTILE FABRIC OR OTHER METHODS MAY BE IMPLEMENTED TO REDUCE EXCESSIVE SOIL MOISTURE AND FACILITATE EARTHWORK OPERATIONS. THIS WILL BE DONE AT NO ADDITIONAL COST TO THE GOVERNMENT. ALL COMMUNICATION WITH CONTRACTOR SHALL BE COORDINATED WITH AND THROUGH THE COR TO CHANGE OR CLARIFY THE CONTRACT DOCUMENTS. ANY FIELD DIRECTIVES WILL BE COORDINATED WITH AND ISSUED BY THE COR.

FOUNDATIONS:

1. FOUNDATIONS SHALL BE CAST ON PROPERLY COMPACTED SOIL. NATIVE SOILS SHALL BE COMPACTED TO AT LEAST 95% TO THE MAXIMUM DRY DENSITY AT ±2% OF OPTIMUM MOISTURE (ASTM D1557).

2. WHERE NATIVE SOILS ARE LOOSE, SATURATED OR UNSTABLE AND DO NOT MEET THE ALLOWABLE BEARING CAPACITY, NATIVE SOILS SHALL BE OVER-EXCAVATED BELOW THE BOTTOM OF THE FOOTING ELEVATION TO SOIL ELEVATION MEETING THE DESIGN PARAMETERS. THE OVER-EXCAVATED AREAS SHALL BE BACK FILLED AND COMPACTED USING ENGINEERED FILL. SEE SECTION 31 00 00 EARTHWORK FOR ADDITIONAL INFORMATION. SOIL CONDITIONS WILL VARY AND HENCE COMPACTION MUST RELATE TO THE TYPE OF MATERIAL.

3. CONTRACTOR SHALL BE PREPARED TO SHORE AND FORM TRENCH FOOTING WHERE LOOSE SOILS ARE ENCOUNTERED.

4. FOUNDATION DETAILS FOR BOLLARDS NEED TO BE SUBMITTED (AFTER A GEOTECHNICAL STUDY IS COMPLETED). FOUNDATION DETAILS MAY VARY FROM ONE LOCATION TO ANOTHER DEPENDING UPON SOIL TYPE.

5. CONTRACTOR SHALL DEVELOP TRENCH DEWATERING PLANS WHERE NECESSARY PRIOR TO FOUNDATION PLACEMENT.

CAST-IN PLACE CONCRETE:

1. ALL CONCRETE STRENGTH SHALL CONFORM TO SECTION 03 30 00 CAST-IN- PLACE CONCRETE. SEE SECTION 03 30 00 CAST-IN -PLACE CONCRETE FOR ADDITIONAL INFORMATION.

2. CONCRETE WORK TO BE COVERED IN ACCORDANCE WITH "THE BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE" ACI 318.

3. CONTRACTOR SHALL REVIEW ALL DRAWINGS FOR SIZE AND LOCATION OF EMBEDDED ITEMS AND SLEEVES REQUIRED. THESE ITEMS SHALL BE FURNISHED AND INSTALLED PRIOR TO PLACEMENT OF CONCRETE.

4. ALL MIXING, HANDLING AND TRANSPORTING, PLACING AND CURING OF CONCRETE SHALL BE IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE AMERICAN CONCRETE INSTITUTE.

5. THE ONLY PERSONS AUTHORIZED TO ADD WATER TO THE CONCRETE TRUCK AT THE JOB SITE ARE THE QC TESTING REPRESENTATIVE. IF APPROVED, THE QC TESTING REPRESENTATIVE IS REQUIRED TO NOTIFY THE COR AND QA TESTING REPRESENTATIVE.

6. ALL EXPOSED EDGES SHALL BE CAST WITH $\frac{3}{4}$ INCH CHAMFERS UNO.

REINFORCING STEEL:

1. REINFORCING STEEL SHALL CONFORM TO SECTION 03 20 00.00 10 CONCRETE REINFORCING. NO TACK WELDING OF REINFORCING SHALL BE PERMITTED. PLACEMENT AND DETAILING OF CONCRETE REINFORCEMENT AND ACCESSORIES SHALL BE IN ACCORDANCE WITH ACI 318 AND ACI SP-66, RESPECTIVELY (LATEST ADDITIONS).

2. REBAR SHALL HAVE A MINIMUM COVER OF 3 INCHES UNLESS OTHERWISE NOTED.

3. HORIZONTAL AND VERTICAL REINFORCING STEEL SHALL BE CONTINUOUS ACROSS CONSTRUCTION JOINTS.

4. CONSTRUCTION JOINTS NOT INDICATED ON THE DRAWINGS SHALL BE MADE AND LOCATED AS NOT TO IMPAIR SIGNIFICANTLY THE STRENGTH OF THE STRUCTURE. CONTRACTORS SHALL SUBMIT LOCATION OF PROPOSED JOINTS IN THE SLABS AND WALLS TO ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION.

STRUCTURAL STEEL:

1. STRUCTURAL STEEL SHALL BE PROCURED BY THE CONTRACTOR IN ACCORDANCE WITH SECTION 05 12 00 STRUCTURAL STEEL.

2. STRUCTURAL STEEL SHALL CONFORM TO SECTION 05 12 00 STRUCTURAL STEEL. SEE SECTION 05 12 00 STRUCTURAL STEEL FOR ADDITIONAL INFORMATION.

3. WELDED CONNECTIONS FOR STRUCTURAL STEEL SHALL CONFORM TO THE LATEST REVISED CODE OF THE AMERICAN WELDING SOCIETY, AWS D1.4.

4. STRUCTURAL STEEL SHALL CONFORM TO THE AISC "SPECIFICATIONS FOR DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDING", LATEST EDITION.

US Army Corps of Engineers ®

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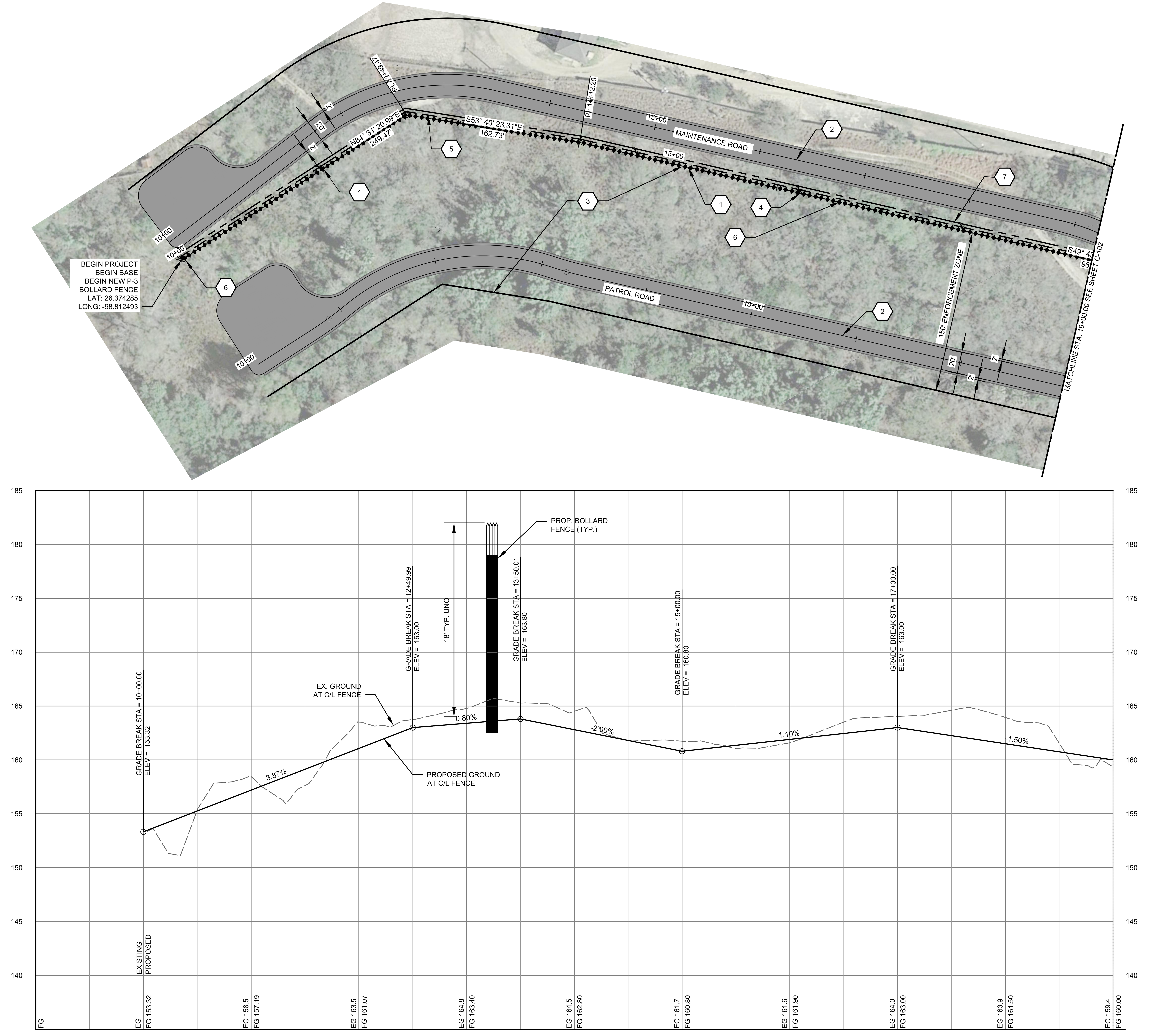
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

GENERAL NOTES

SHEET ID
RGC
G-003



A1 PLAN AND PROFILE
SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

1" = 50' - 0" 1" = 5' - 0"

GENERAL NOTES

1. THIS SHEET IS AT 35% CONCEPT DESIGN AND NOT TO BE USED FOR CONSTRUCTION.
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3. CONTRACTOR SHALL ENSURE THAT ALL DESIGNS MEET TACTICAL INFRASTRUCTURE STANDARDS, LATEST EDITION.
4. CONTRACTOR SHALL VERIFY LOCATION OF ALL UTILITIES, IRRIGATION CULVERTS AND DRAINAGE STRUCTURES, AND ADJUST/RELOCATE AS REQUIRED TO DE-CONFLICT WITH THE PROPOSED BOLLARD WALL AND ENFORCEMENT ZONE (I.E.: EX. IRRIGATION VALVES TO BE RELOCATED TO NORTH LEVEE EMBANKMENT).
5. CONTRACTOR SHALL DESIGN AND INSTALL ALL DRAINAGE SYSTEMS FOR THIS PROJECT.
6. LIGHTING LOCATIONS ARE CONCEPTUAL. CONTRACTOR TO PROVIDE FINAL LIGHTING COMPUTATIONS AND LOCATIONS.

XX KEYNOTES

1. PROPOSED NEW TYPE P-3 BOLLARD FENCE.
2. PROPOSED TYPE FC-2 AGGREGATE ALL-WEATHER ROAD.
3. CLEAR VEGETATION AND GRADE WITHIN ENFORCEMENT ZONE.
4. PROPOSED LIGHT POLE, PULLBOX, AND LIGHTING - SEE ELEC. FOR LOCATIONS (TYP).
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6. PROPOSED FENCE GROUNDING LOCATIONS.
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8. GATE ELECTRICAL DISTRIBUTION EQUIPMENT.
9. GATE GROUNDING LOCATIONS.
10. PROPOSED MOTORIZED VEHICLE SLIDE GATE.
11. PROPOSED RVSS SITE.
12. CONCEPTUAL ELECTRICAL UTILITY CONNECTION POINT.
13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

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DRAWN BY: X
CHECKED BY: X
SUBMITTED BY: X
SIZE: ANSI D
ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

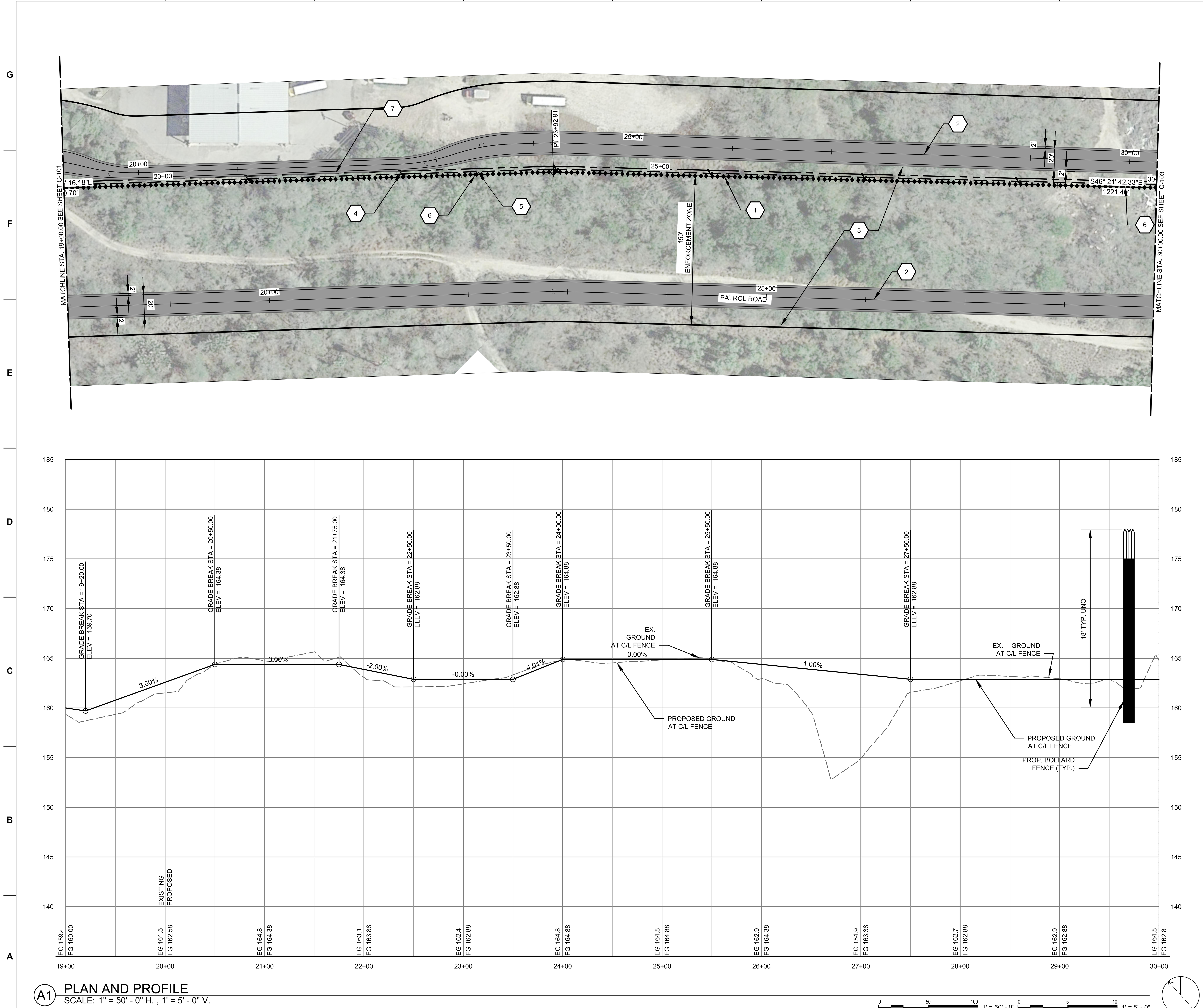
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 10+00.00 - 19+00.00

SHEET ID
RGC
C-101



A1 PLAN AND PROFILE
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1" = 50' - 0" 1' = 5' - 0"

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KEYNOTES

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12. CONCEPTUAL ELECTRICAL UTILITY CONNECTION POINT.
13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

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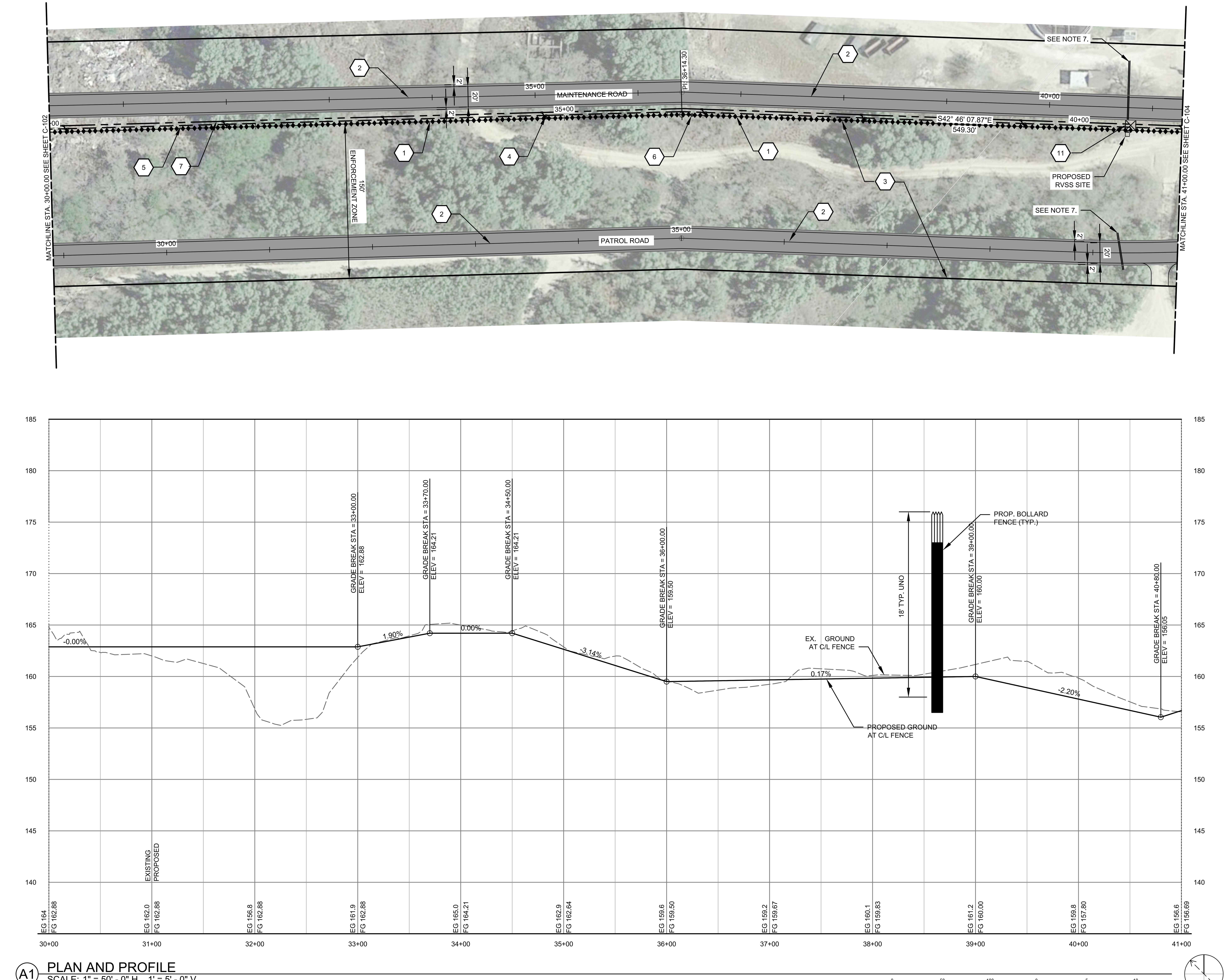
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 19+00.00 - 30+00.00

SHEET ID
RGC
C-102



A1 PLAN AND PROFILE

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6. LIGHTING LOCATIONS ARE CONCEPTUAL. CONTRACTOR TO PROVIDE FINAL LIGHTING COMPUTATIONS AND LOCATIONS.
7. SEE SHEET E-502 FOR TYPICAL PLAN VIEW AT RVSS TOWER.

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US Army Corps of Engineers ®

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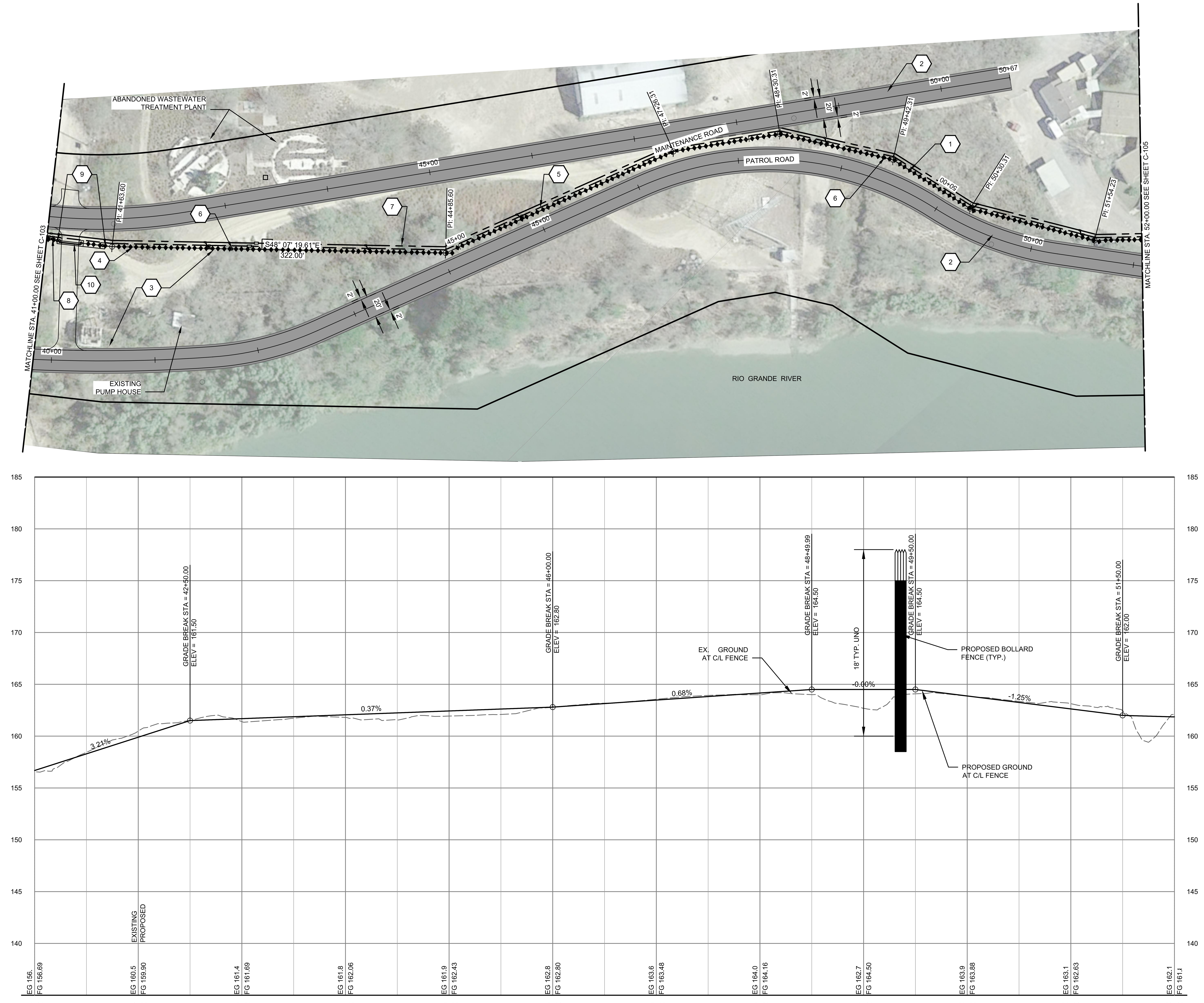
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 30+00.00 - 41+00.00

SHEET ID
RGC
C-103



A1 PLAN AND PROFILE

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US Army Corps of Engineers ®

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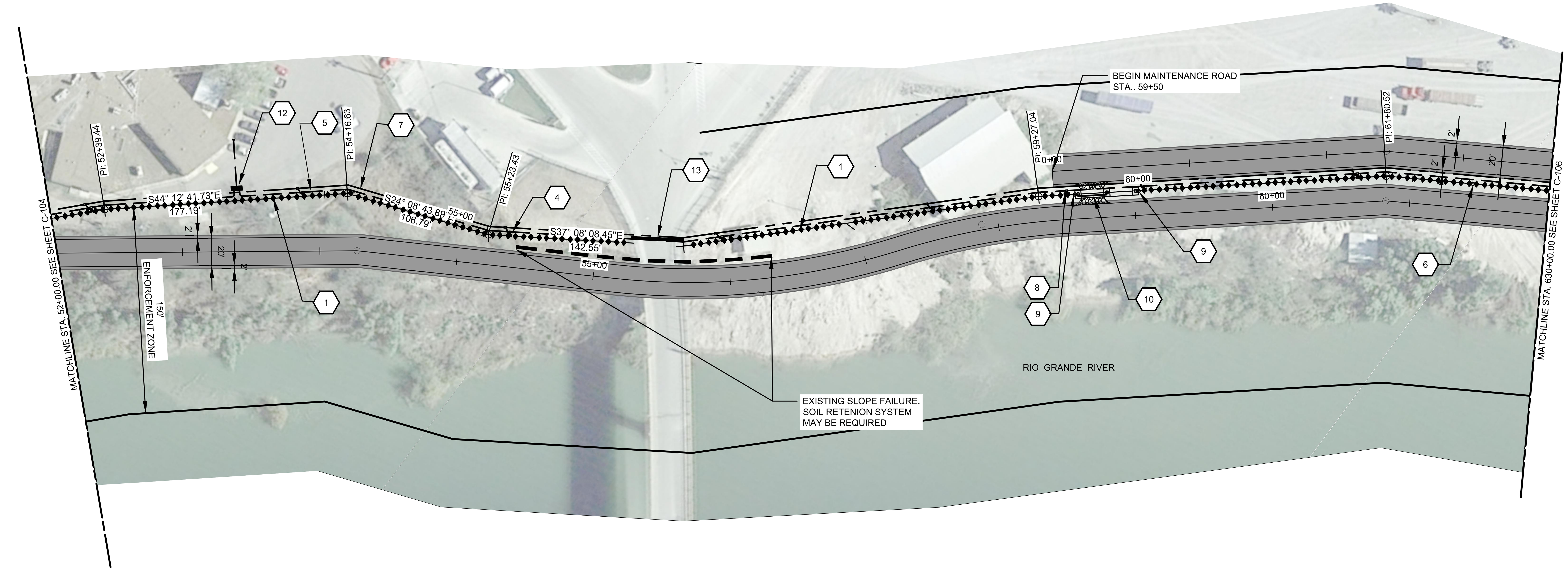
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

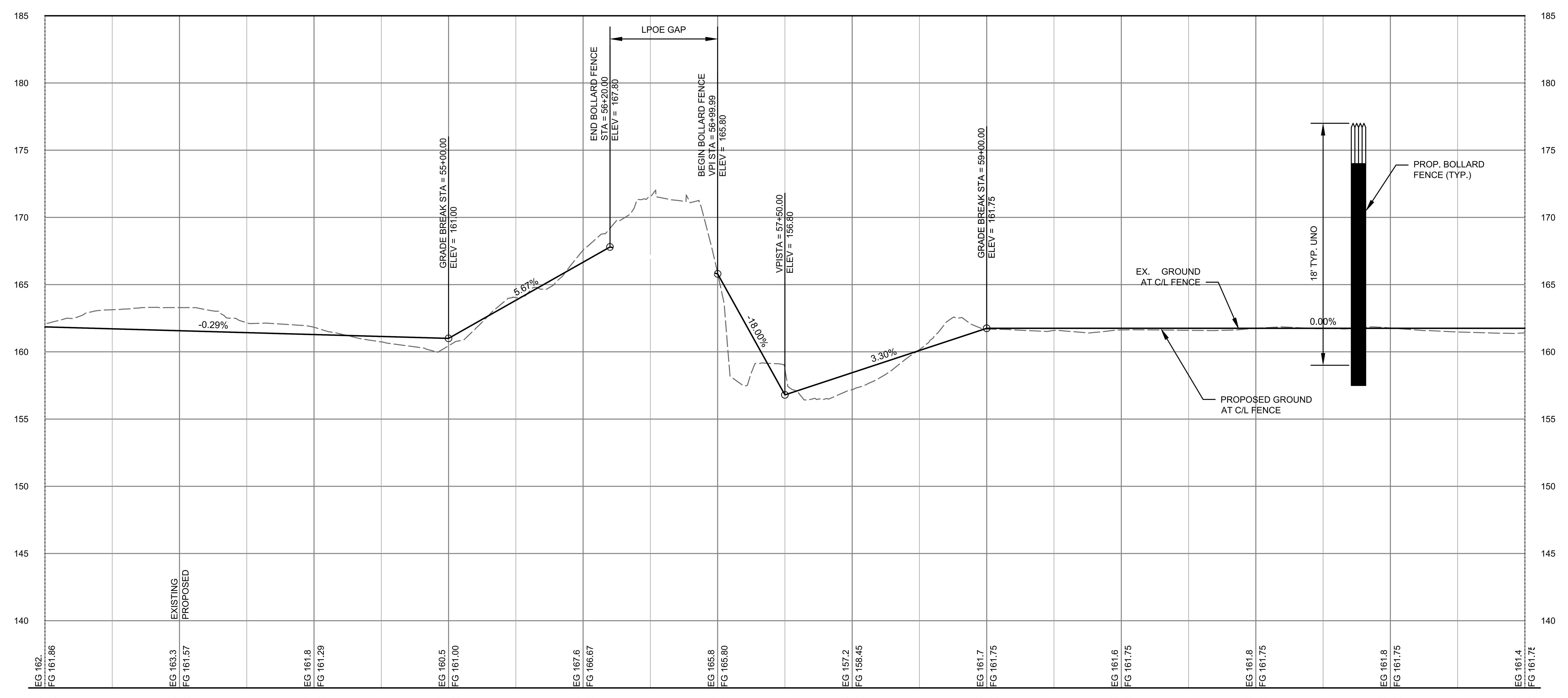
ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 41+00.00 - 52+00.00

SHEET ID
RGC
C-104





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13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

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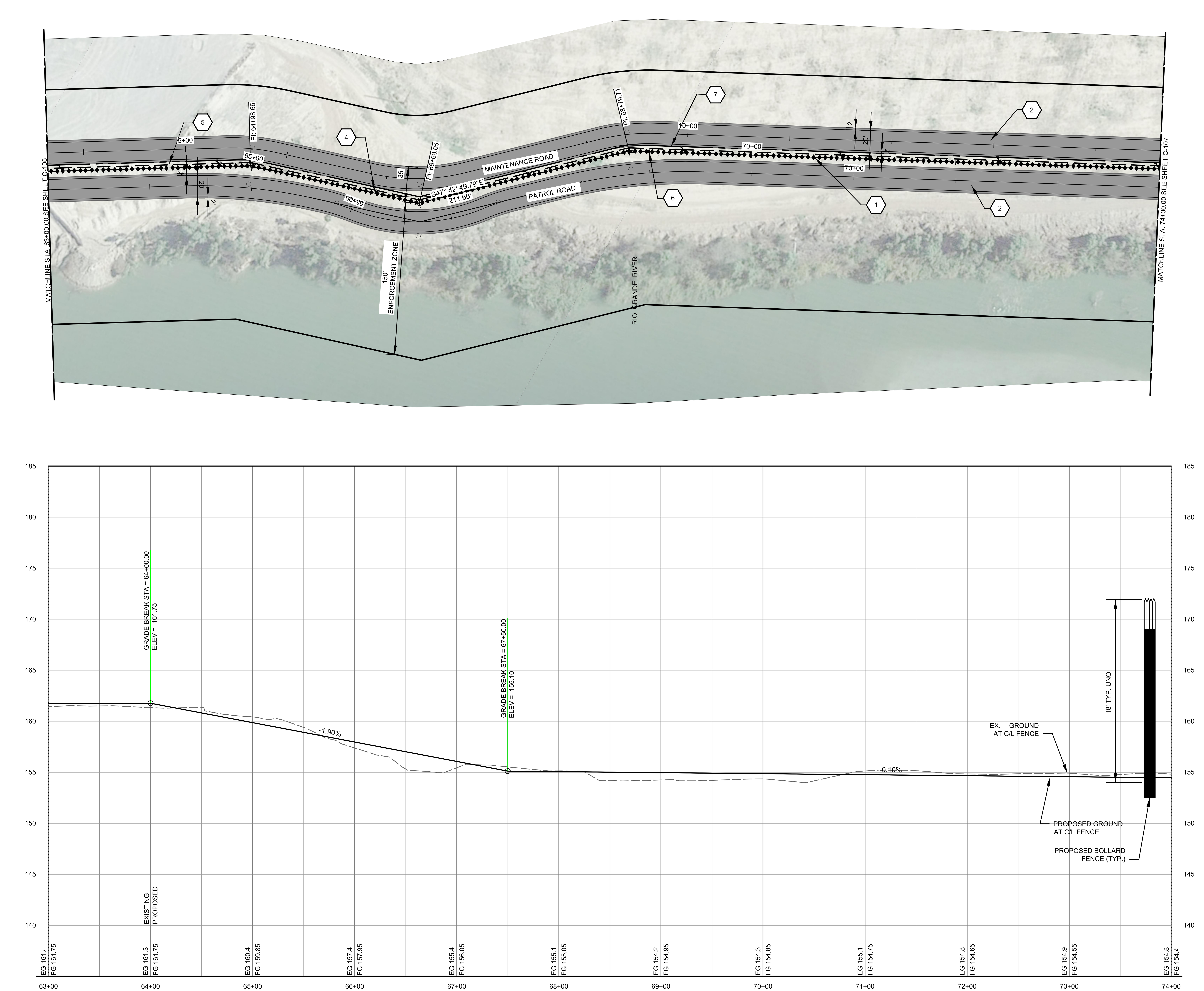
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 52+00.00 - 63+00.00

SHEET ID
RGC
C-105



A1 PLAN AND PROFILE
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US Army Corps of Engineers ®

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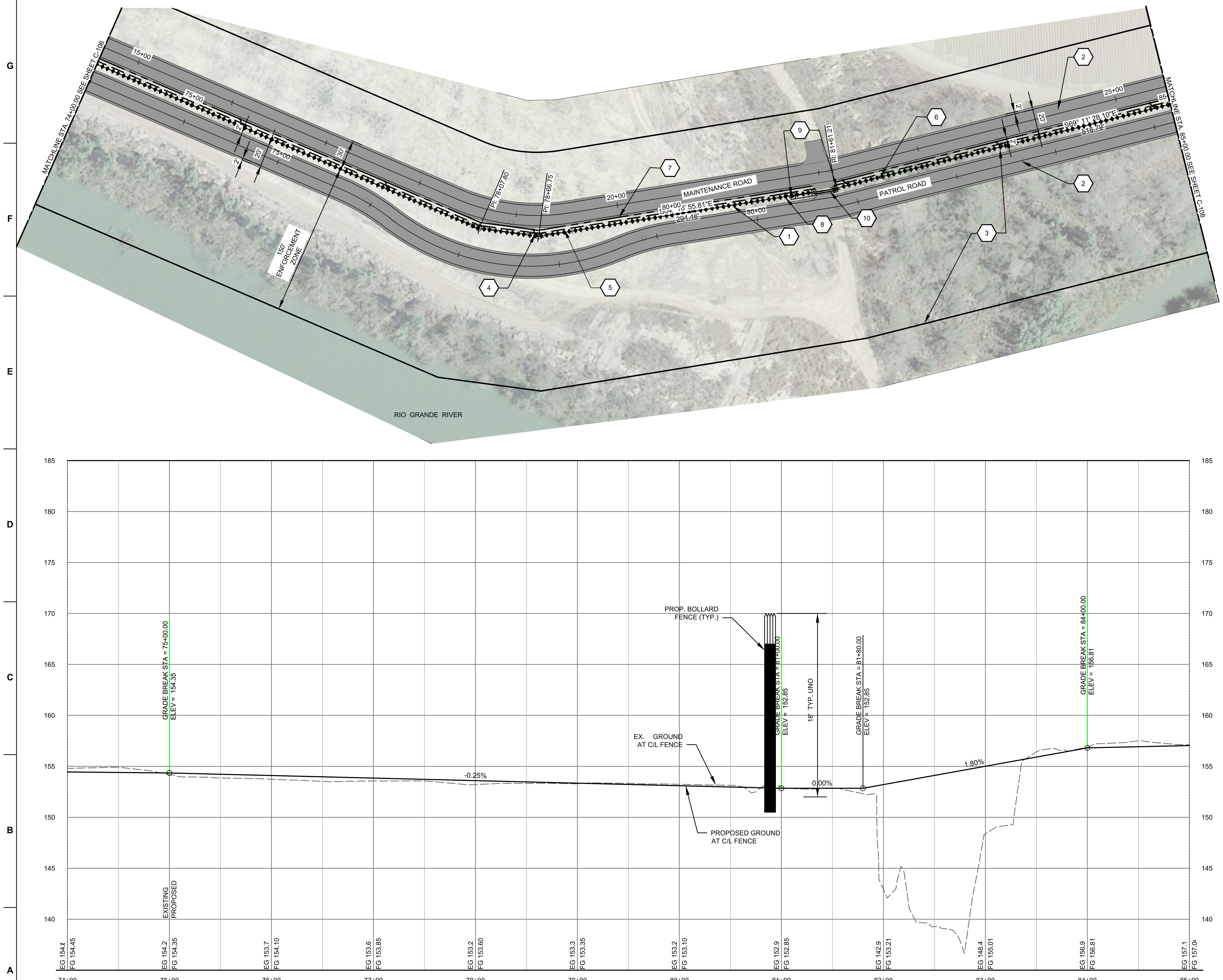
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 63+00.00 - 74+00.00

SHEET ID
RGC
C-106



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US Army Corps of Engineers ®

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US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 74+00.00 - 85+00.00

SHEET ID
RGC
C-107

GENERAL NOTES

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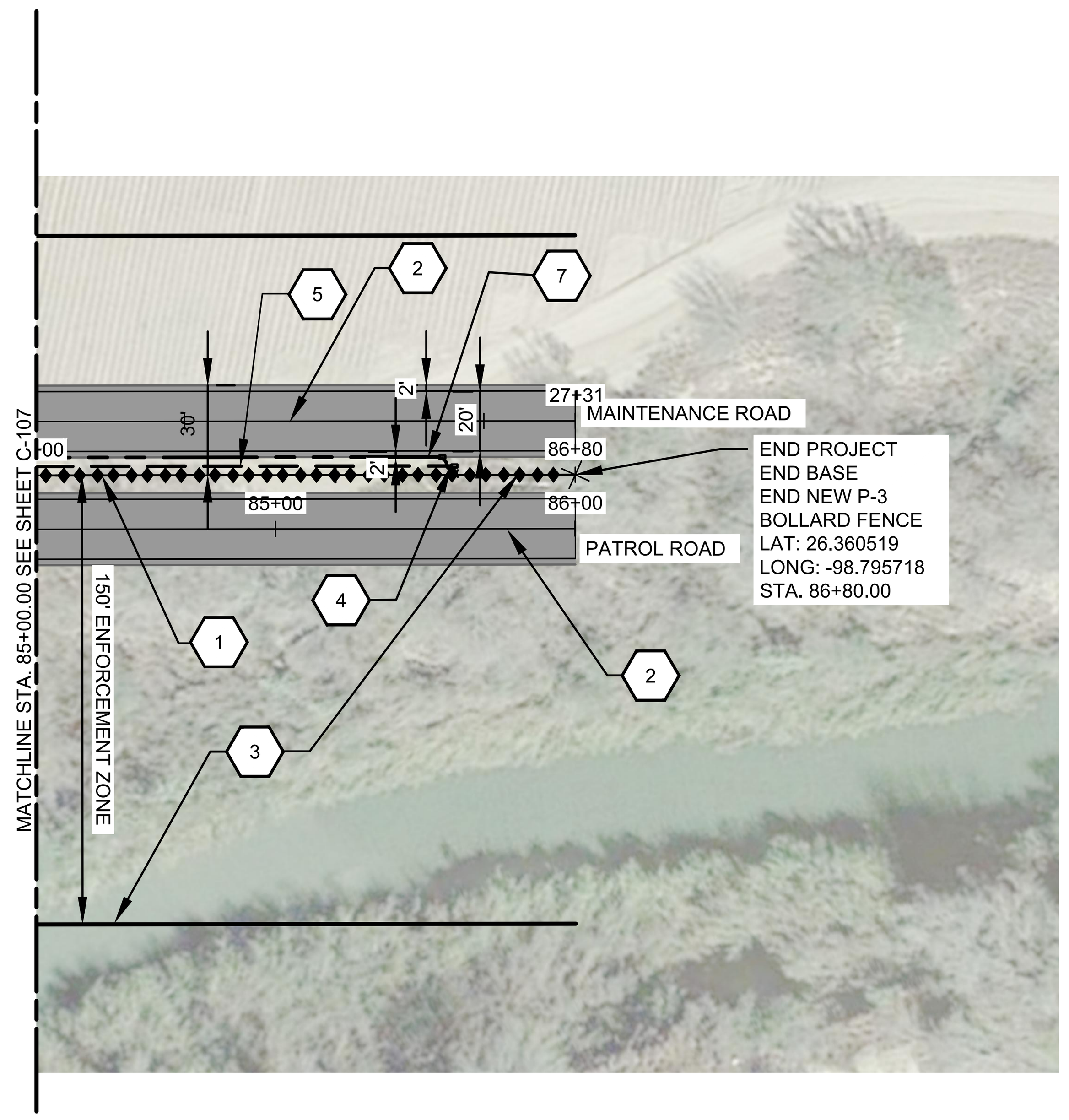

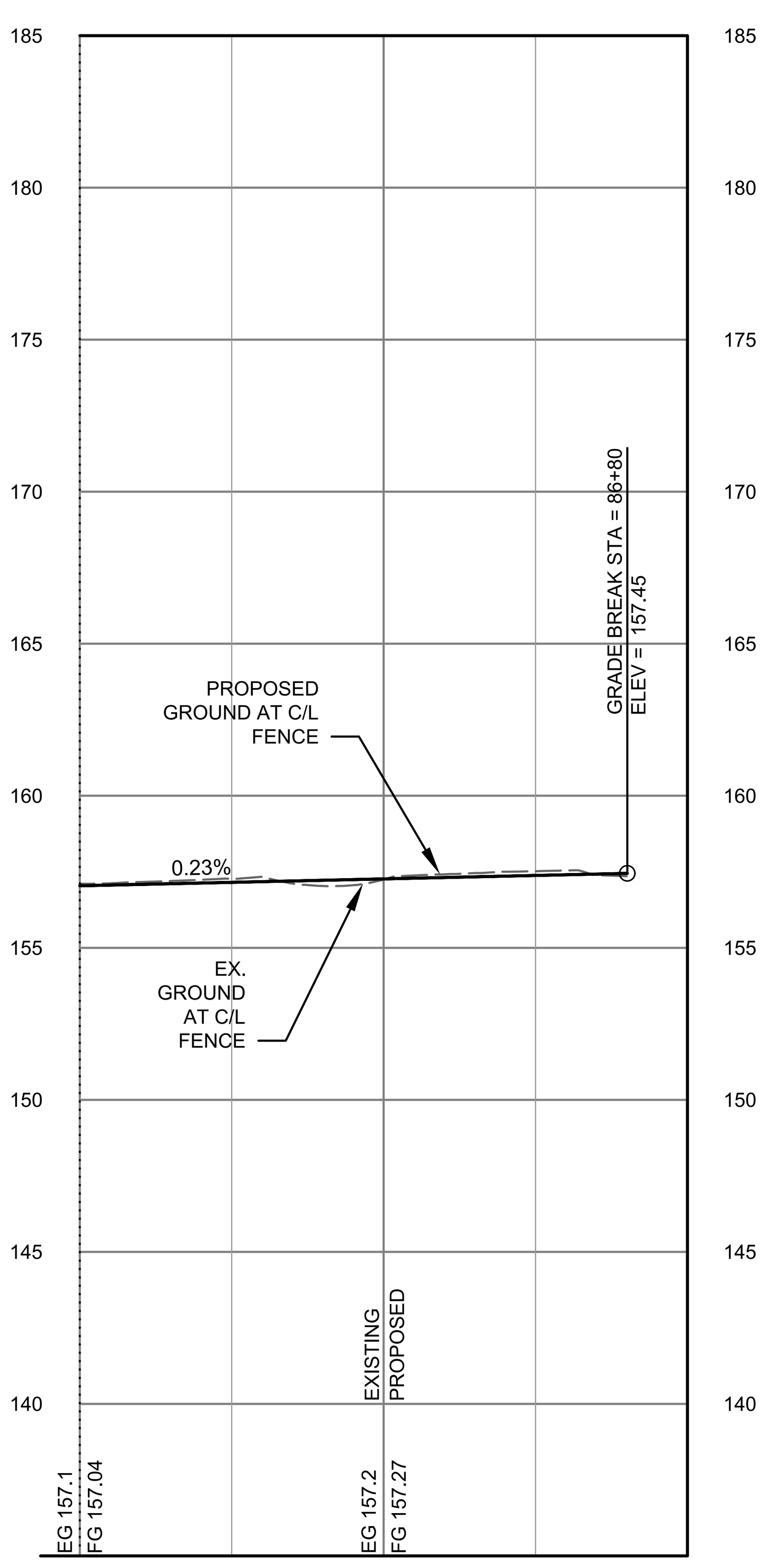

A1 PLAN AND PROFILE
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0 50 100 1' = 50' - 0" 0 5 10 1' = 5' - 0"

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ETEGRA
17218 PRESTON RD., SUITE 3300
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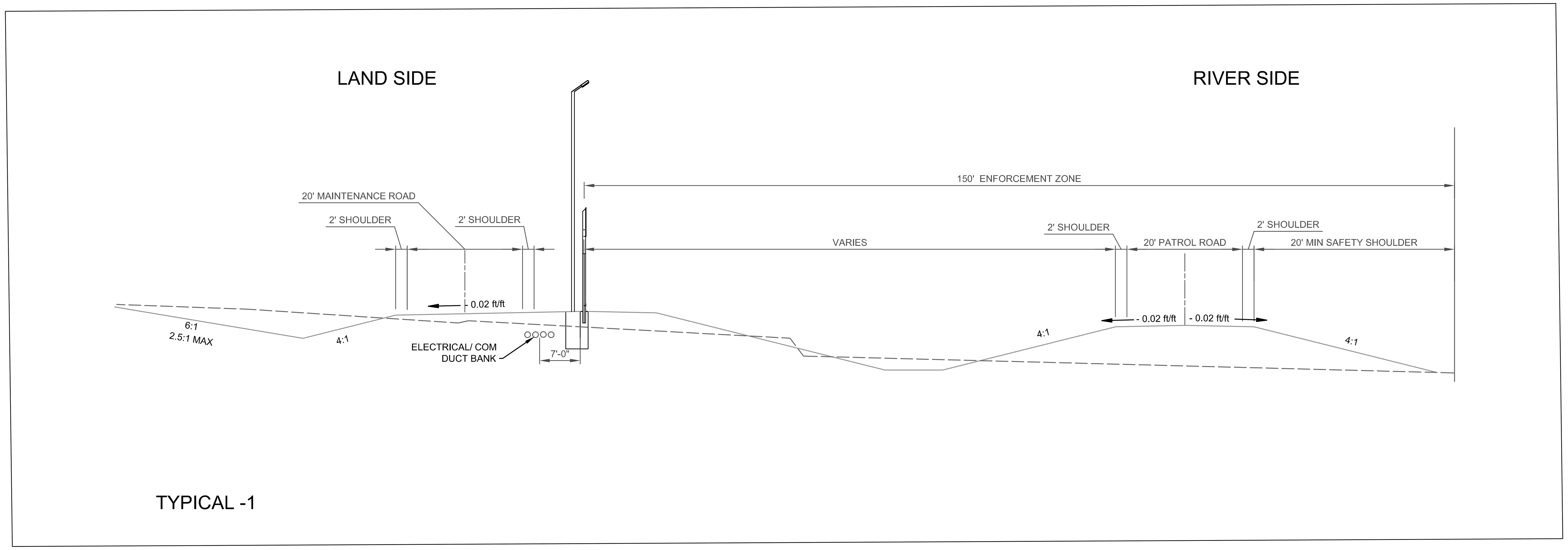
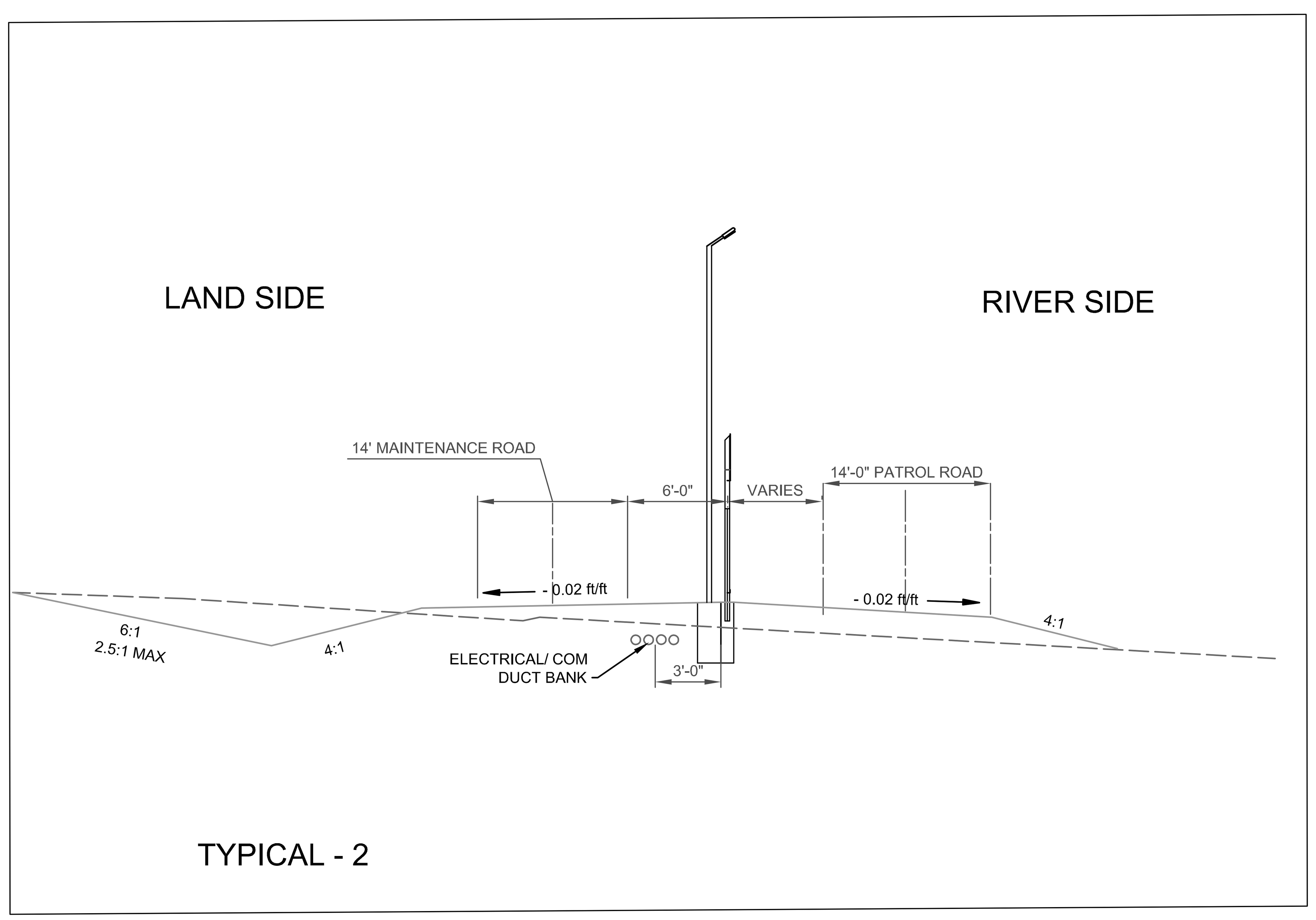
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 85+00.00 - 86+38.00

SHEET ID
RGC
C-108



TYPICAL -1



TYPICAL - 2

A1 TYPICAL CROSS SECTION
SCALE: 1" = 150'

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

DESIGNED BY: X
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SUBMITTED BY: X
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US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
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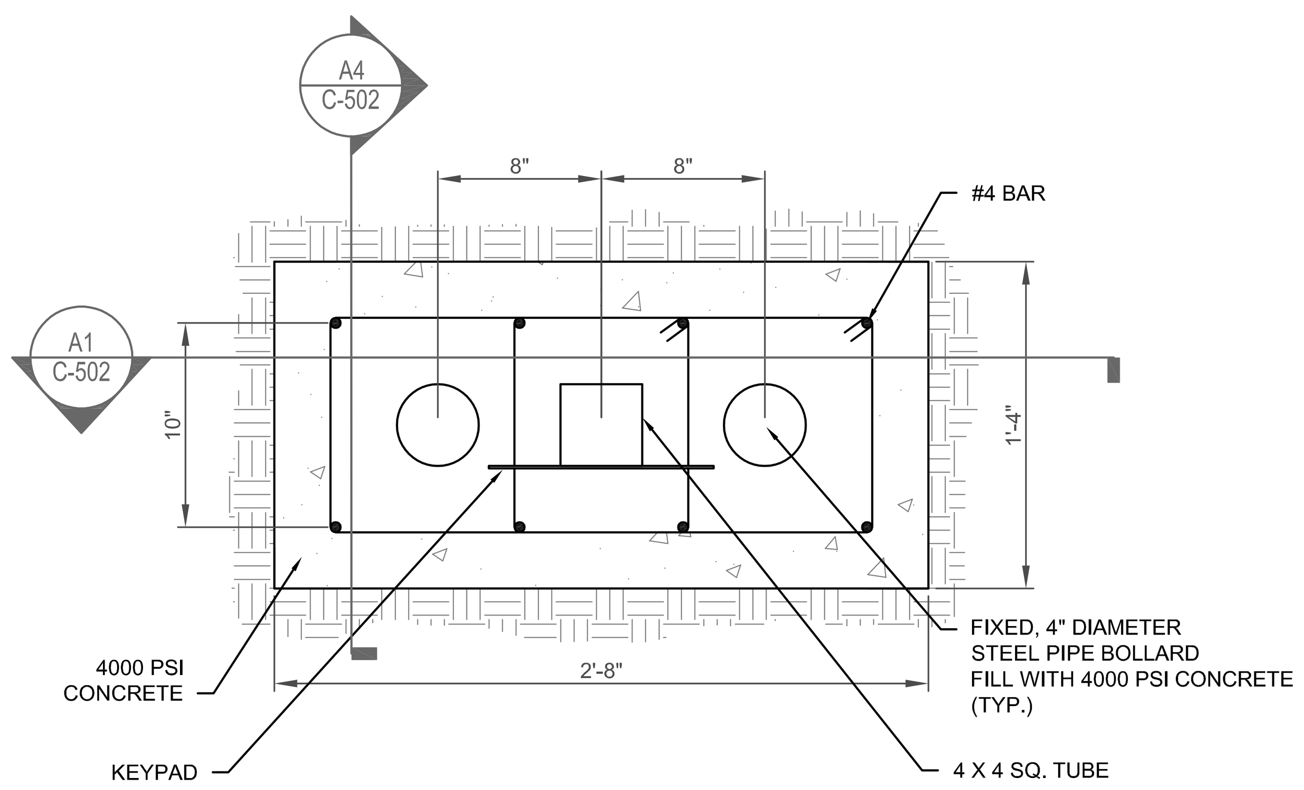
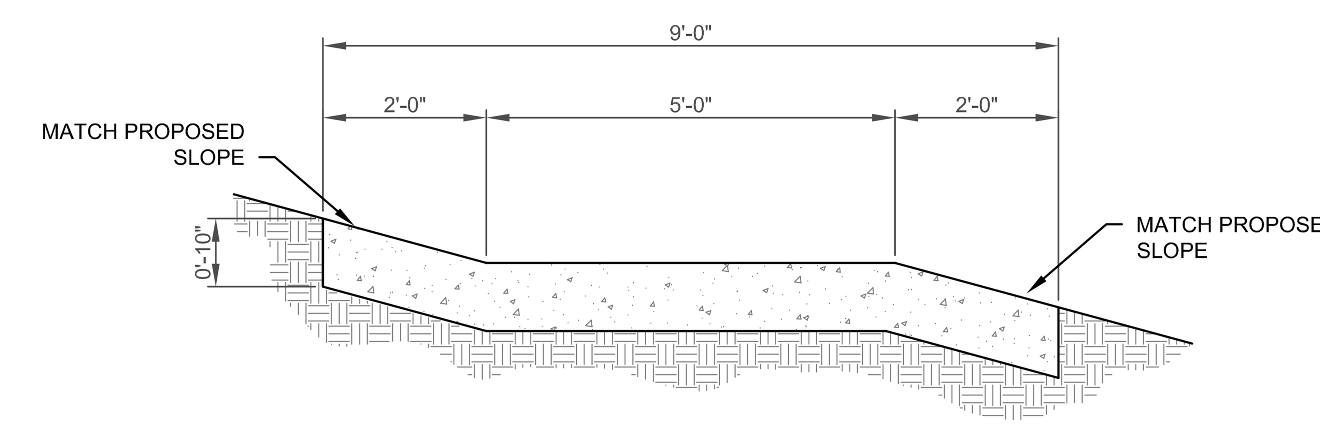
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE
TYPICAL CROSSECTION

SHEET ID
RGC
C-301

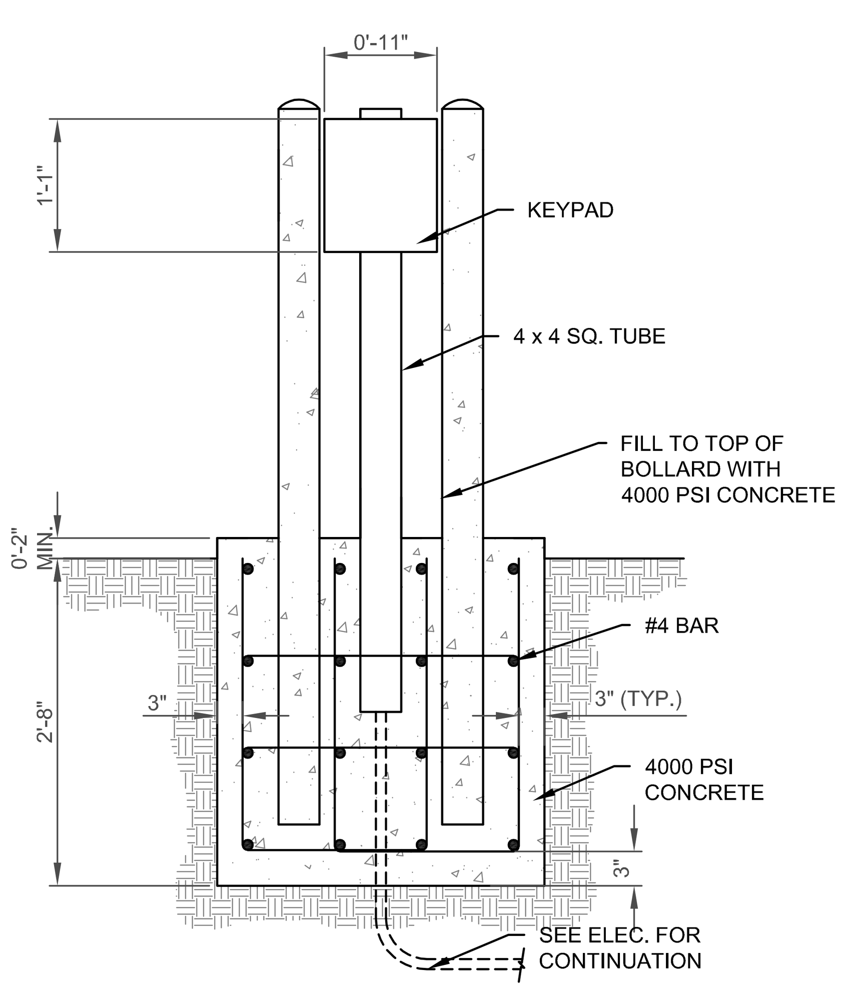
GENERAL NOTES



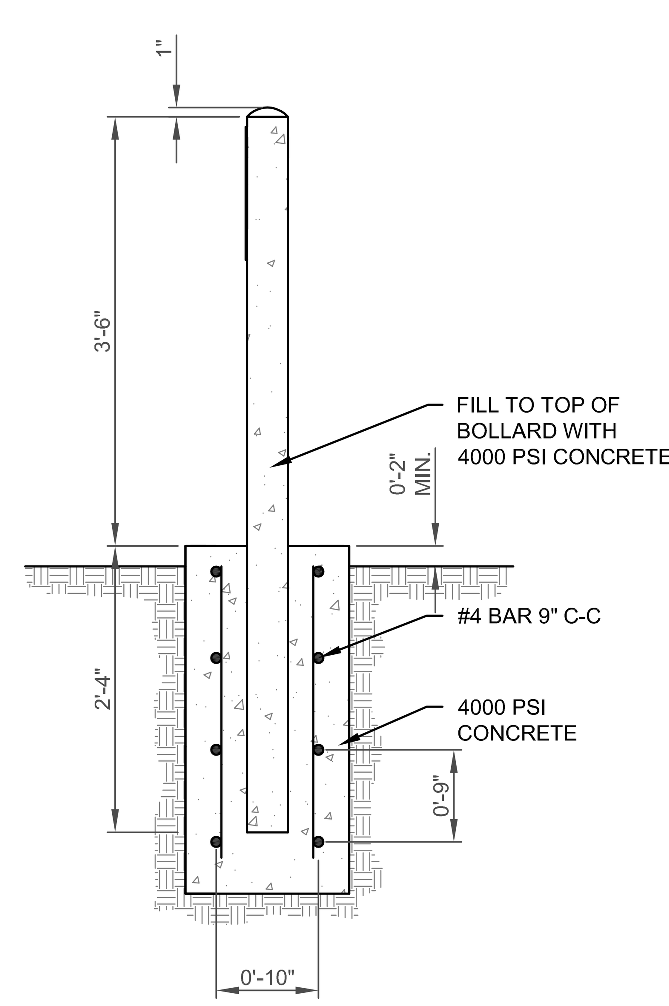
D1 KEYPAD MOUNTING DETAIL
SCALE: N.T.S.



C6 10" CONCRETE ROAD CROSSING SLAB
SCALE: N.T.S.



A1 KEYPAD MOUNTING DETAIL
SCALE: N.T.S.



A4 KEYPAD MOUNTING DETAIL
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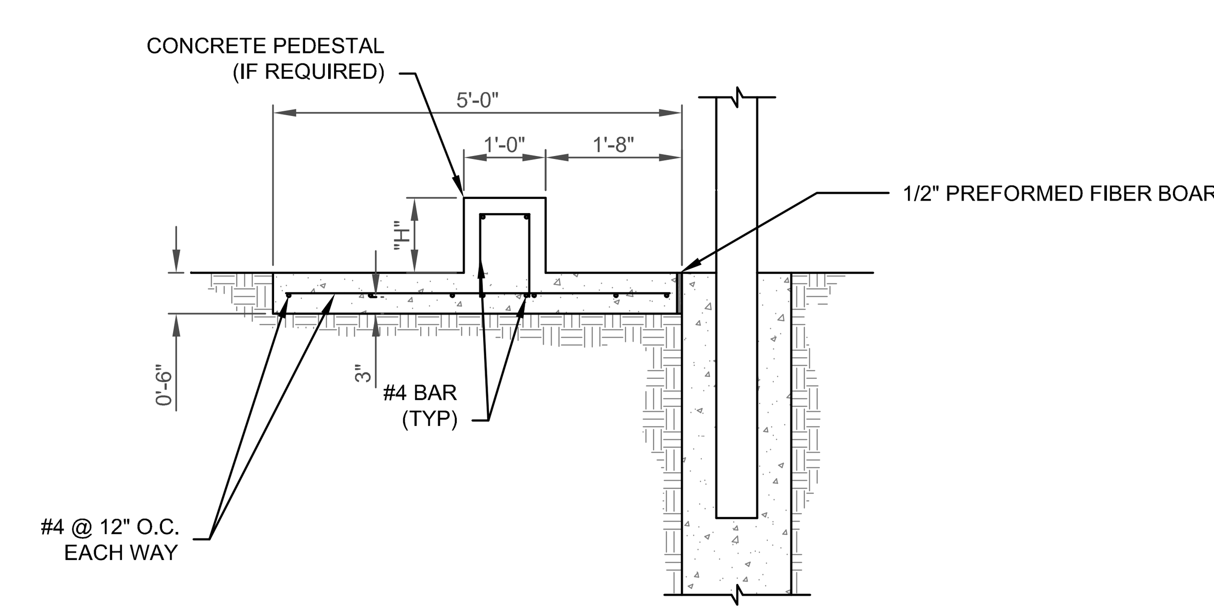

A6 6" CONCRETE SLAB
SCALE: N.T.S.

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MARK	DESCRIPTION	DATE

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CHECKED BY: B.PRESTON
SUBMITTED BY: B.PRESTON
SIZE: ANSI D
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GALVESTON DISTRICT
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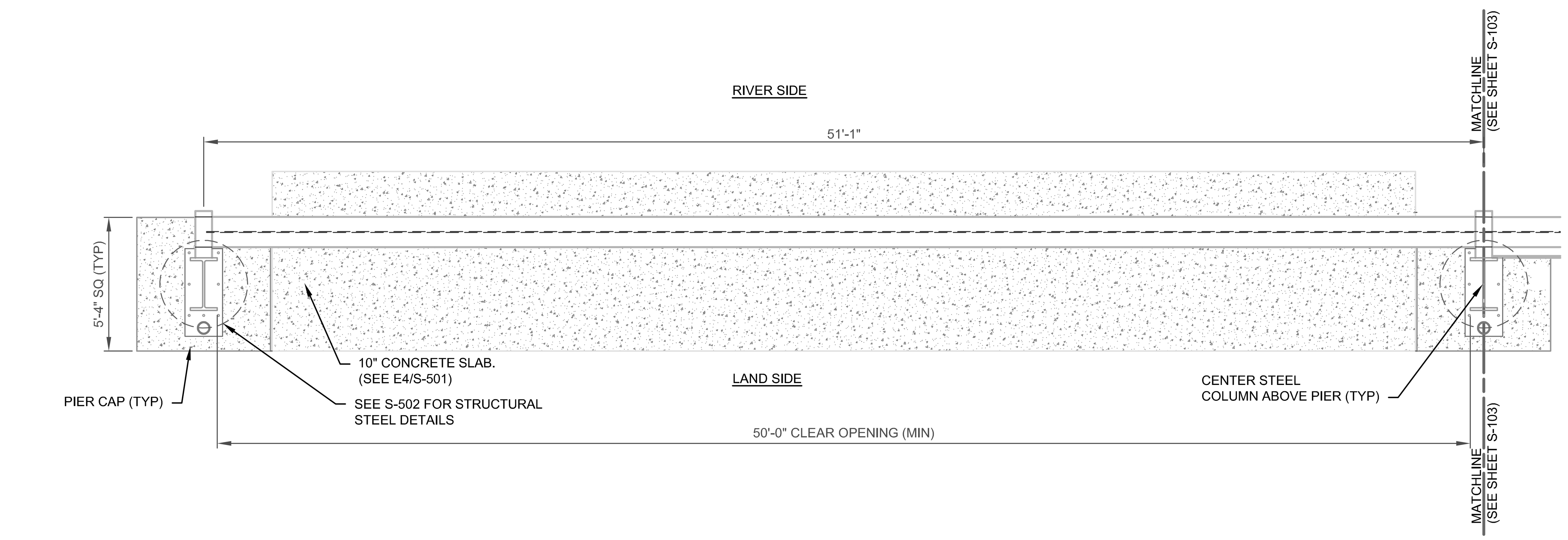
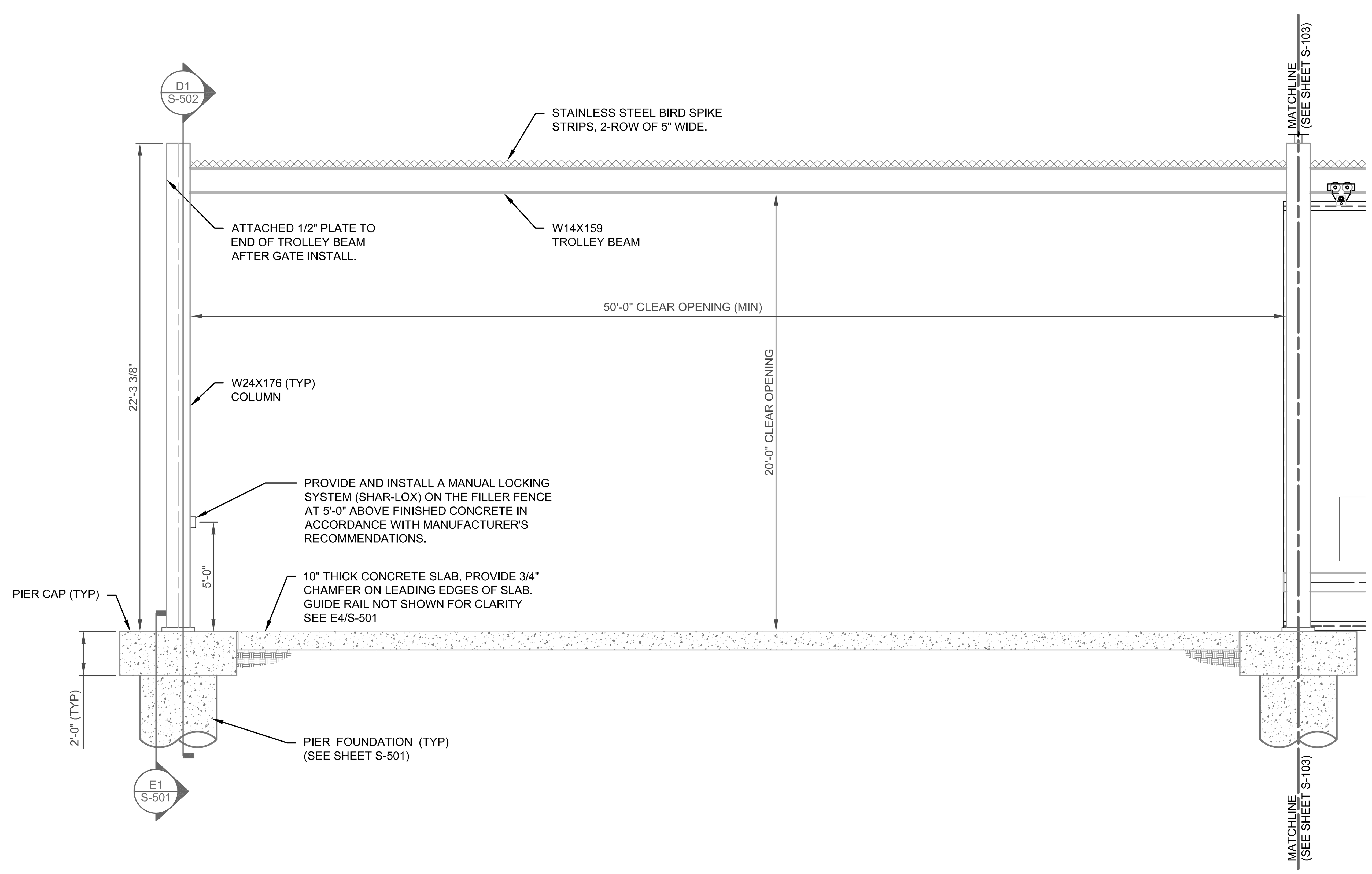
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

ROAD CROSSING AND KEYPAD MOUNT DETAILS

SHEET ID
RGC
C-501



E2 PLAN - 50 FT. AUTOMATED GATE
SCALE: N.T.S



A2 ELEVATION - 50 FT. AUTOMATED GATE (LOOKING TOWARD RIVER SIDE)
SCALE: N.T.S

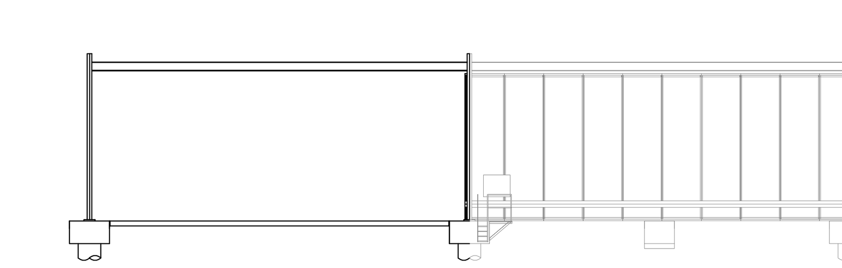
GENERAL NOTES

1. FOR BASE PLATE AND BOLT DETAIL REFER TO DRAWING S-501 AND S-502.
2. FOR GATE OPERATOR PLATFORM REFER TO DRAWING S-503.
3. PROVIDE STEEL PLATES, WELDED TO TOP OF COLUMNS #1 AND #2 AND BOLTED TO THE LIGHT POST BASEPLATE. SEE DETAIL E7/S-502 FOR DETAILS.
4. ANY GAP BETWEEN FENCE AND GATE SHALL BE NO MORE THAN 4".
5. EARTHWORK SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 31 00 00.
6. INSTALL 1 1/2" DIA GALVANIZED STEEL LADDER TO ACCESS GATE OPERATOR. LADDER RUNGS SHALL BE EQUALLY SPACE (8") 1" SQ GALVANIZED STEEL BARS WITH NON-SLIP TREATMENT ON TOP OF EACH RUNG. PAINT WELDED SURFACES WITH A CORROSION PROTECTIVE COATING AS NEEDED.
7. MINIMUM LADDER OPENING IS 16" IN WIDTH.

SHEET NOTES

1. SEE SHEET C-501 FOR CROSSING SLAB INFORMATION.

KEYPLAN



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US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
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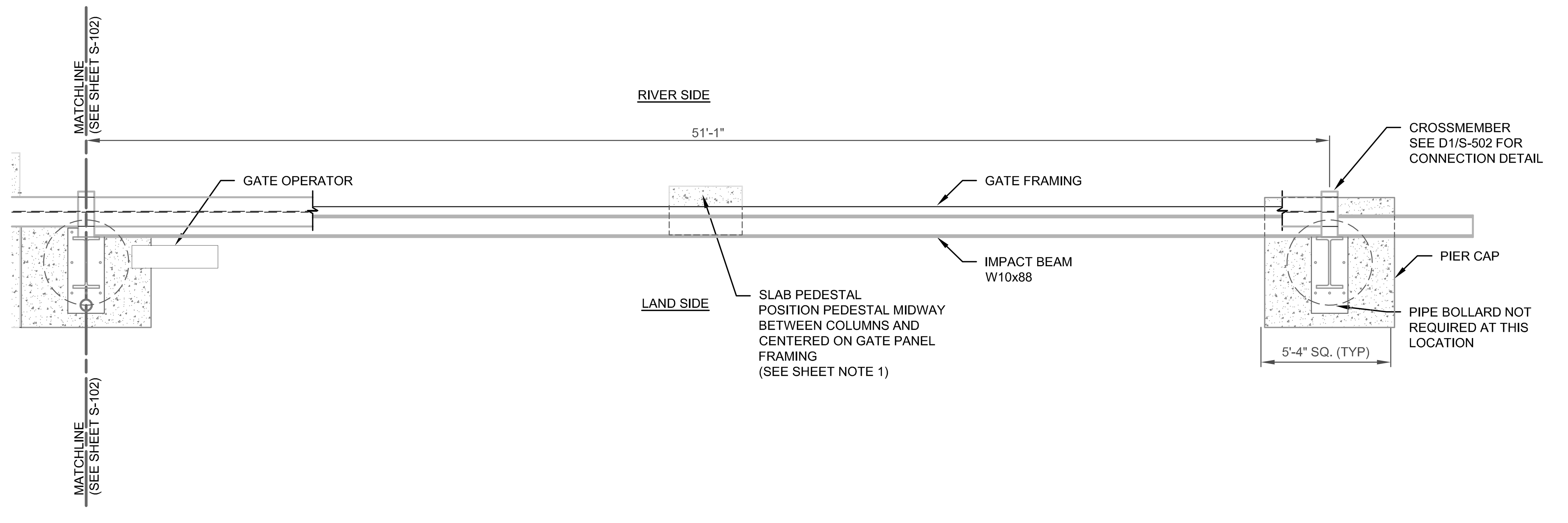
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND ELEVATION
50 FT. SINGLE LEAF AUTOMATED GATE

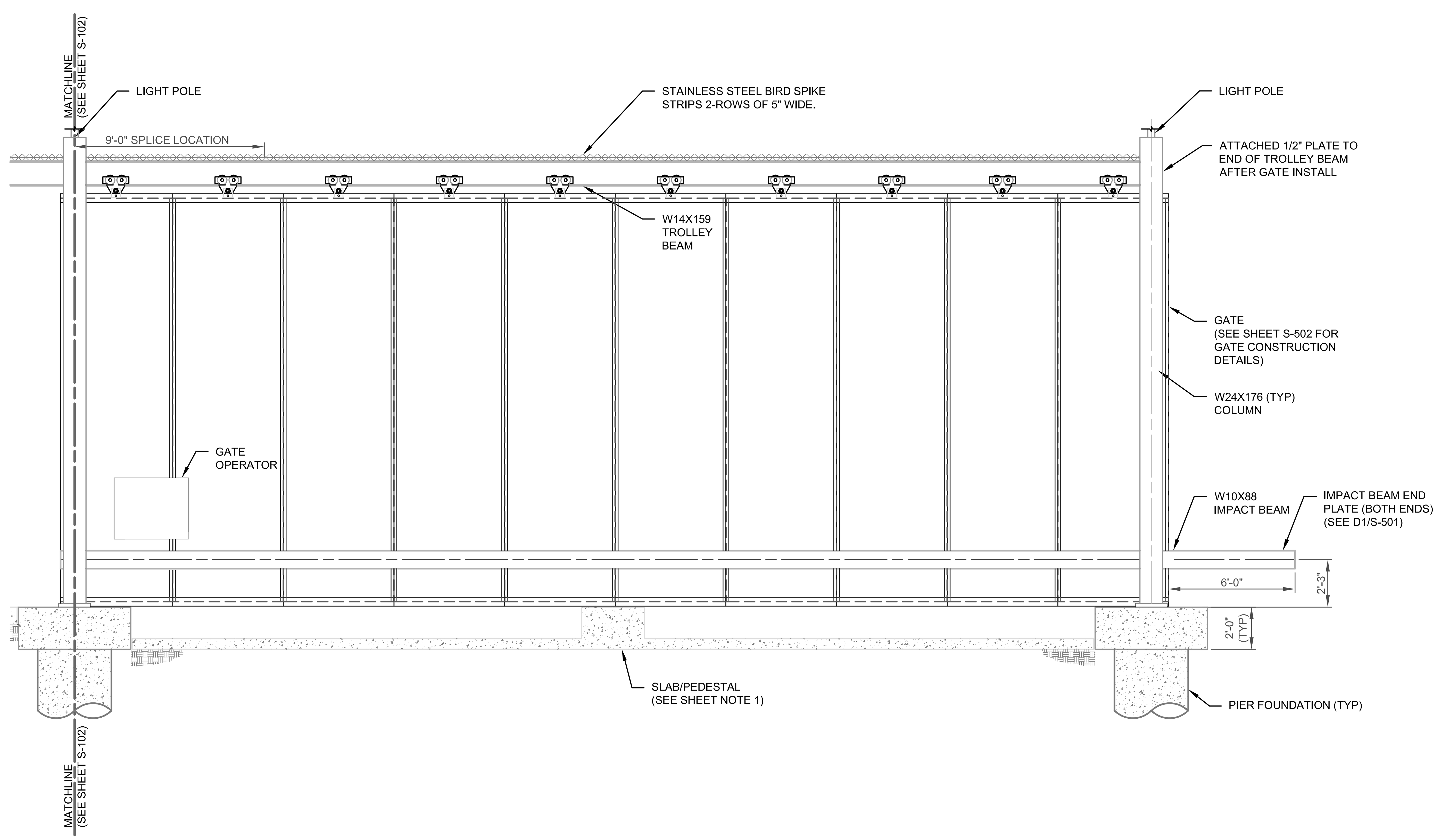
SHEET ID
RGC
S-102

1 2 3 4 5 6 7 8 9 10

G F E D C B A



E2 PLAN - 50 FT. AUTOMATED GATE
SCALE: N.T.S.



A2 ELEVATION - 50 FT. AUTOMATED GATE (LOOKING TOWARD RIVER SIDE)
SCALE: N.T.S.

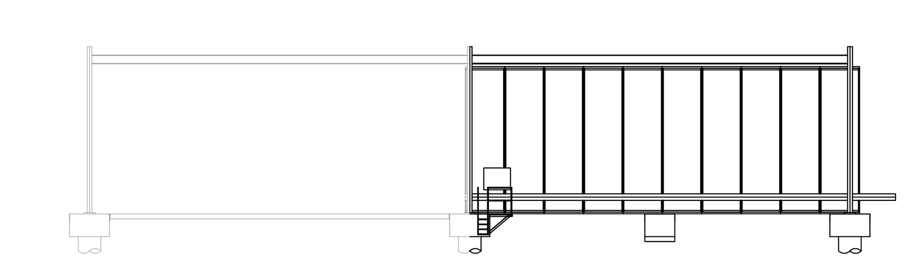
GENERAL NOTES

1. SEE S-102.

SHEET NOTES

1. SEE SHEET C-501 FOR CONCRETE SLAB PEDESTAL INFORMATION WHERE REQUIRED.

KEYPLAN



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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND ELEVATION
50 FT. SINGLE LEAF AUTOMATED GATE

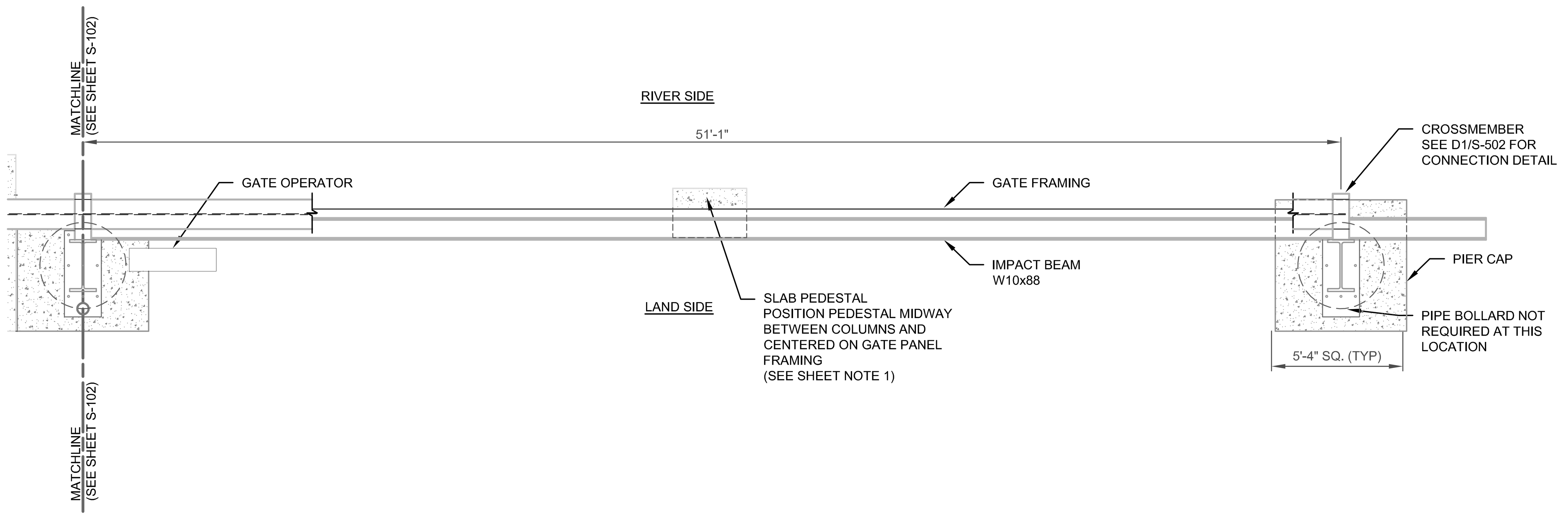
SHEET ID
RGC
S-103

GENERAL NOTES

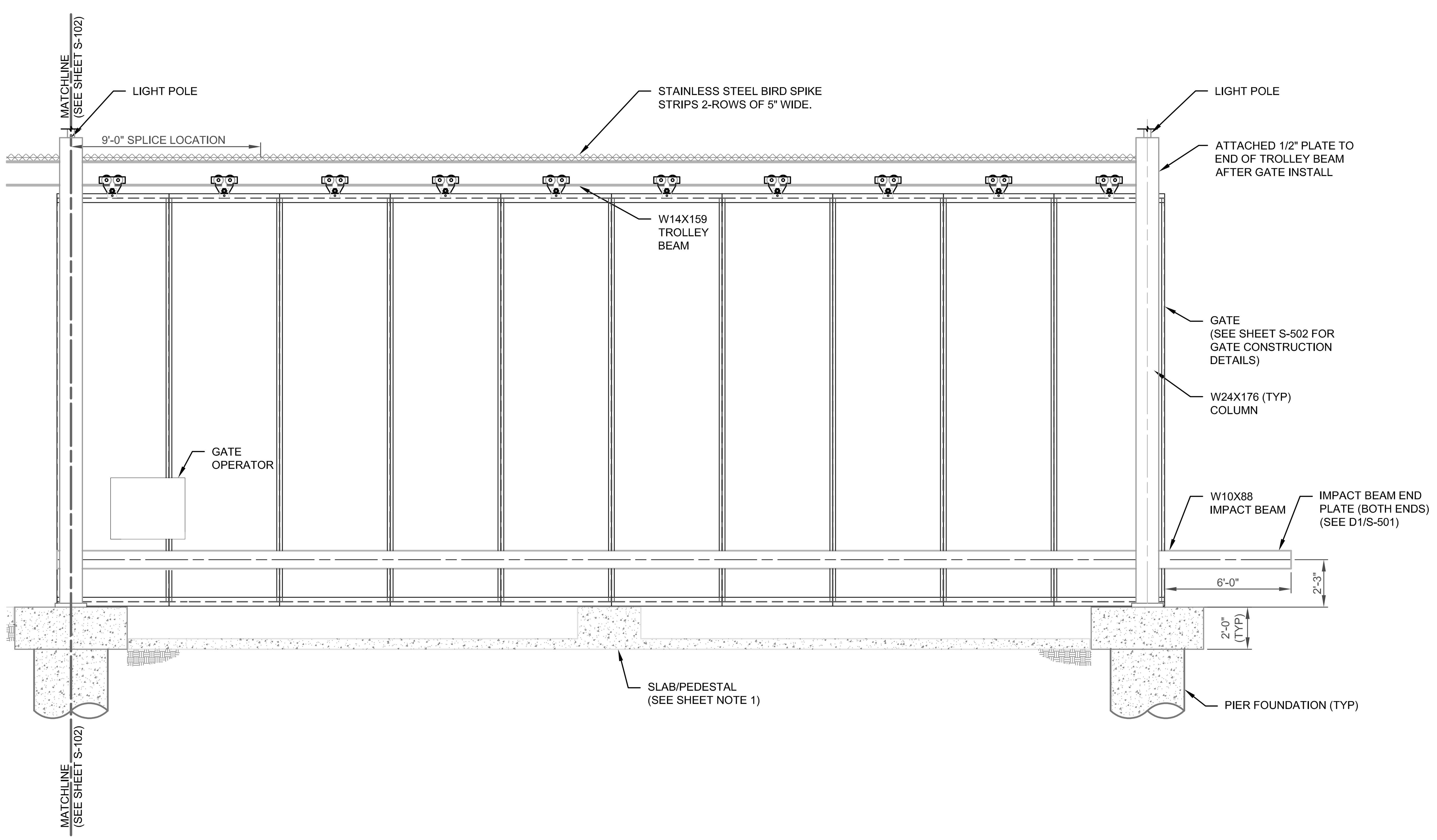
1. SEE S-102.

SHEET NOTES

1. SEE SHEET C-501 FOR CONCRETE SLAB PEDESTAL INFORMATION WHERE REQUIRED.

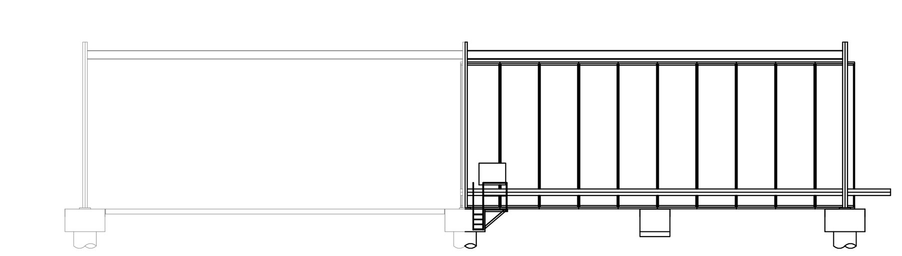


E2 PLAN - 50 FT. AUTOMATED GATE
SCALE: N.T.S.



A2 ELEVATION - 50 FT. AUTOMATED GATE (LOOKING TOWARD RIVER SIDE)
SCALE: N.T.S.

KEYPLAN



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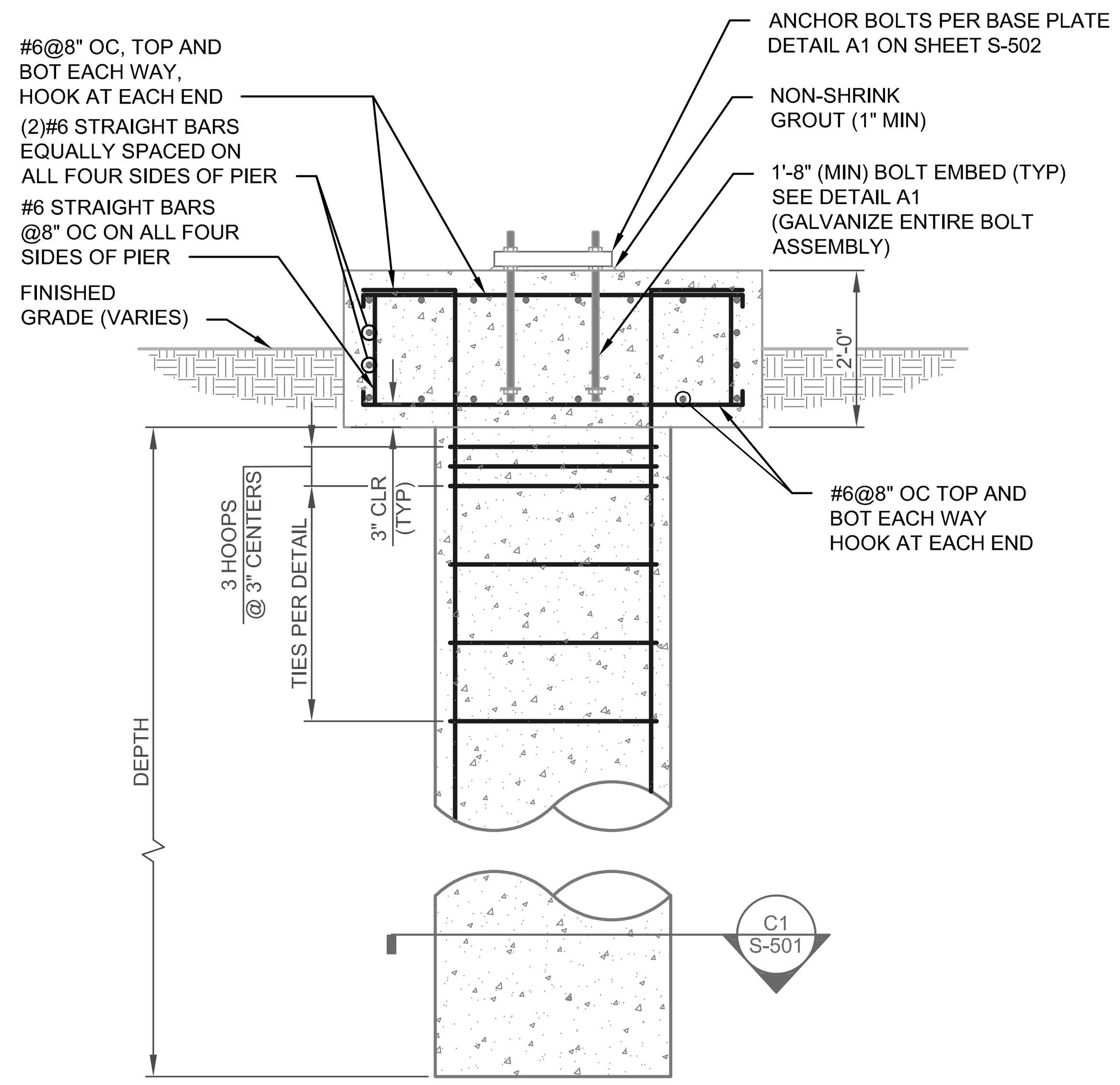
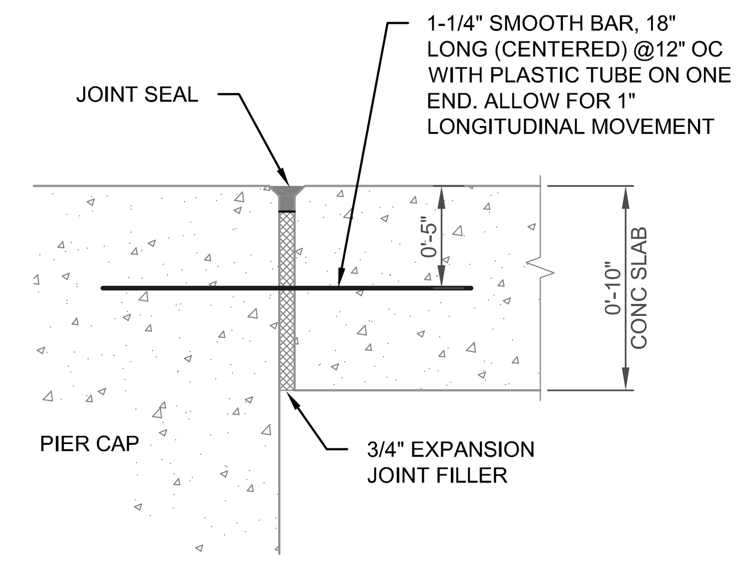
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND ELEVATION
50 FT. SINGLE LEAF AUTOMATED GATE

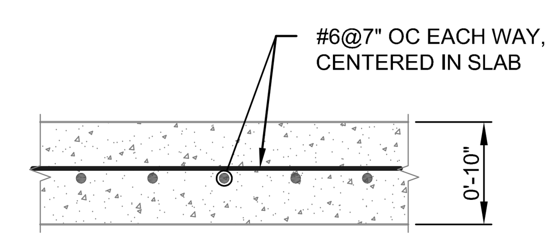
SHEET ID
RGC
S-103



E1 PIER FOUNDATION / PILE CAP REINFORCING DETAIL
SCALE: N.T.S.



F4 SLEEVED EXPANSION JOINT
SCALE: N.T.S.



E4 CONCRETE SLAB REINFORCING
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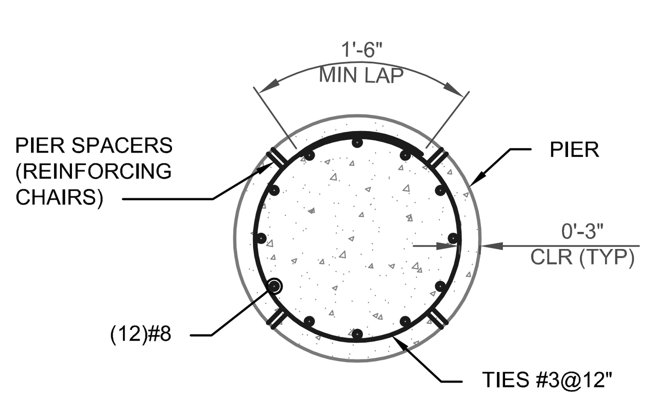
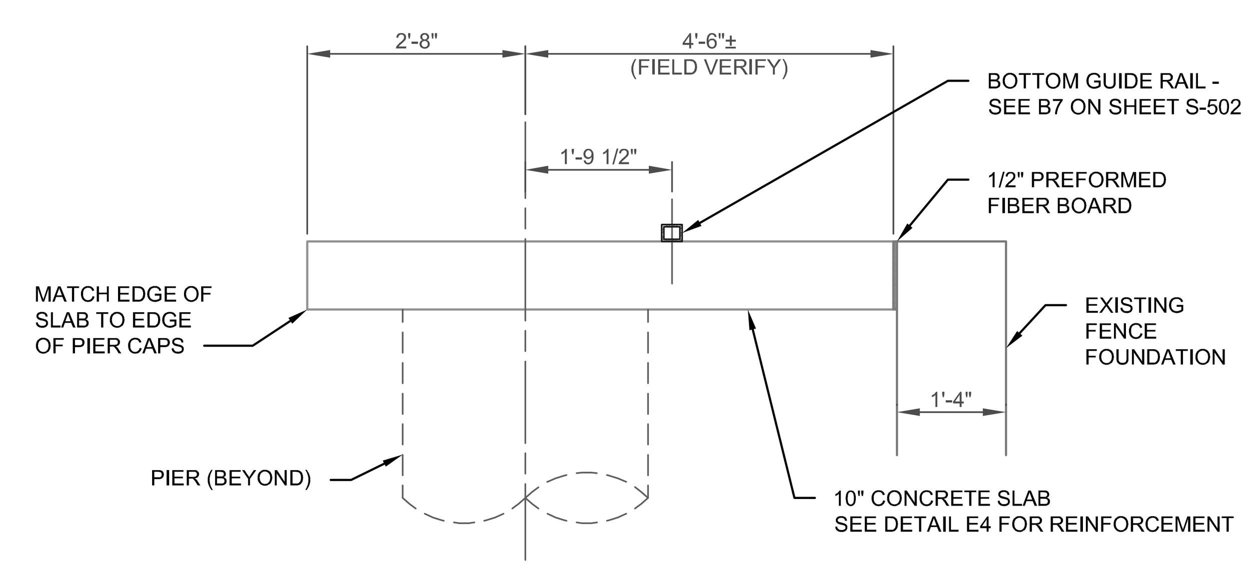
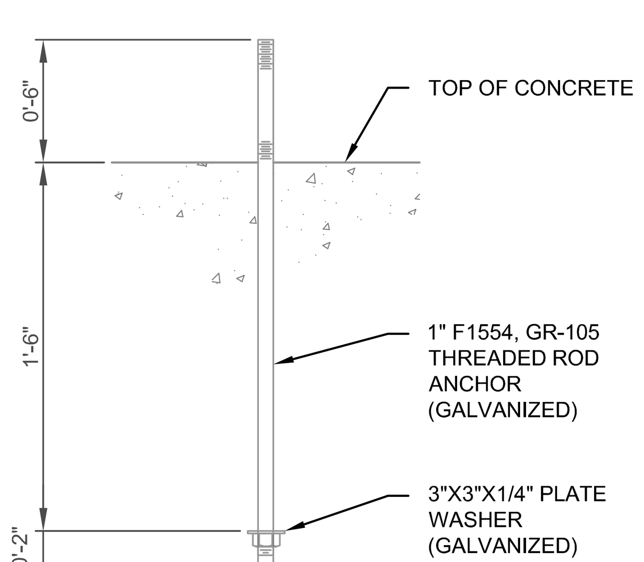


C1 PIER FOUNDATION SECTION
SCALE: N.T.S.



C4 CONCRETE SLAB SIZING DETAIL
SCALE: N.T.S.



A1 ANCHOR BOLT DETAIL
SCALE: N.T.S.

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US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
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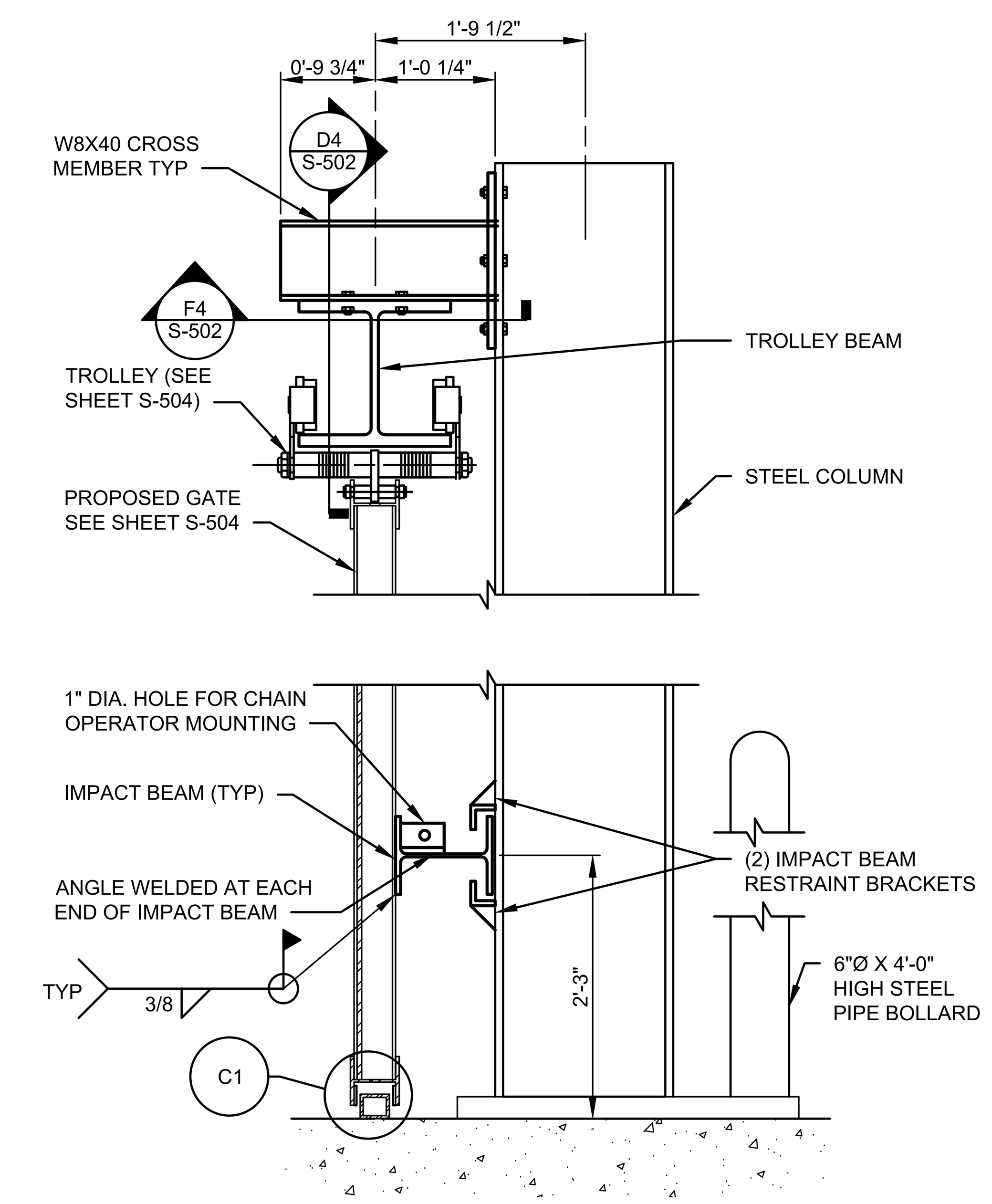
DALLAS, TX, 75252

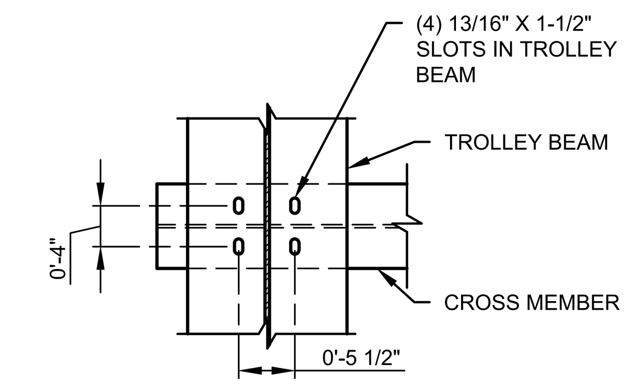
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

CONCRETE DETAILS

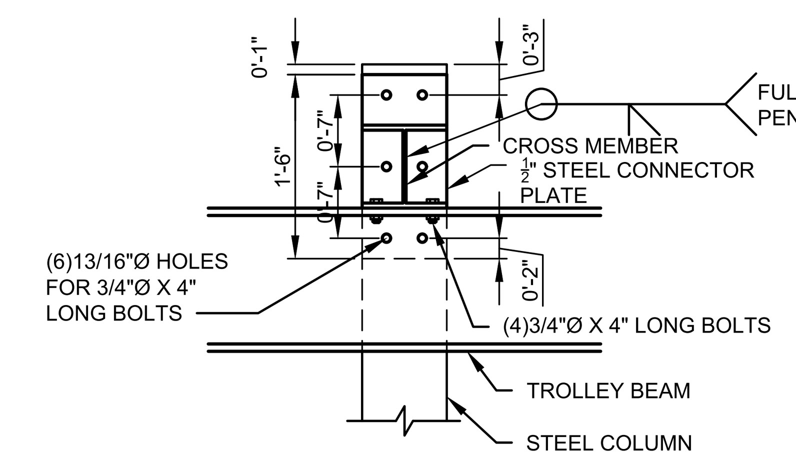
SHEET ID
RGC
S-501



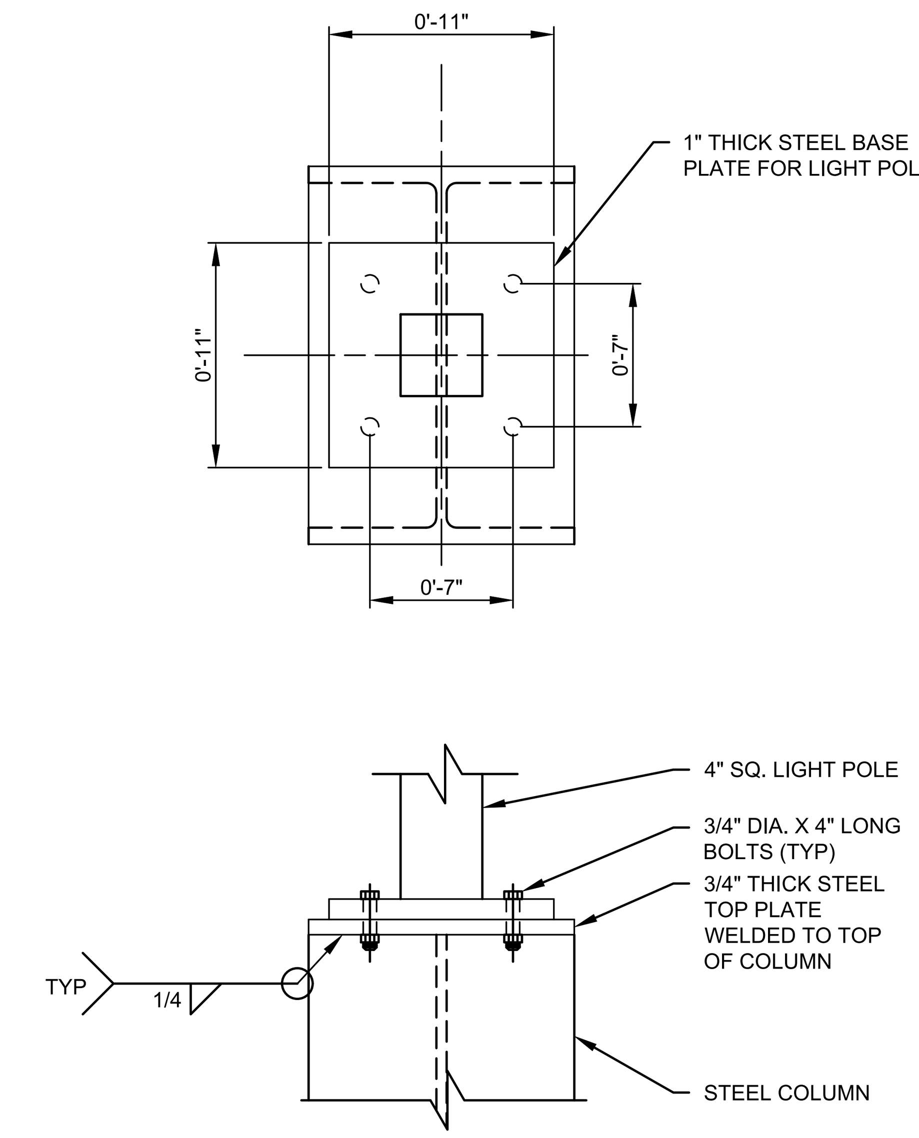
D1 STRUCTURAL COLUMN SECTION
SCALE: N.T.S.



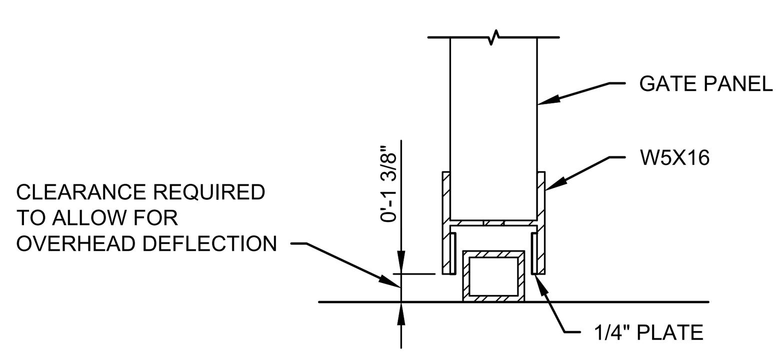
F4 DETAIL
SCALE: N.T.S.



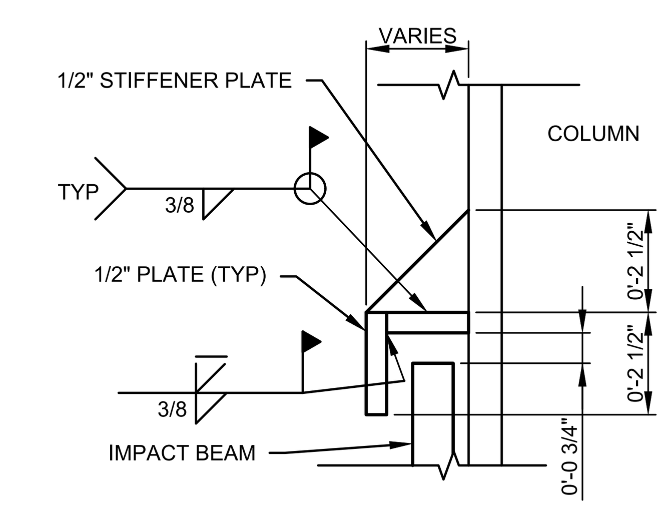
D4 DETAIL
SCALE: N.T.S.



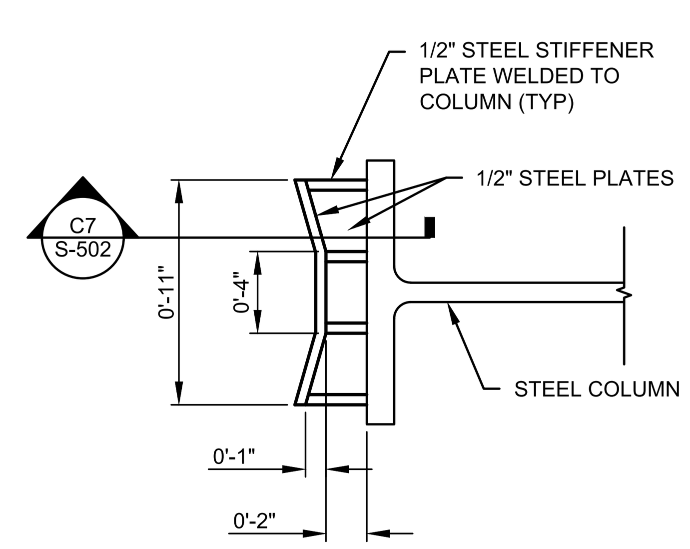
E7 DETAIL - LIGHT POLE CONNECTION
SCALE: N.T.S.



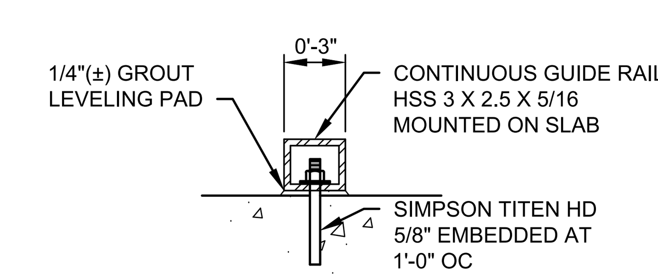
C1 BOTTOM RAIL GUIDE
SCALE: N.T.S.



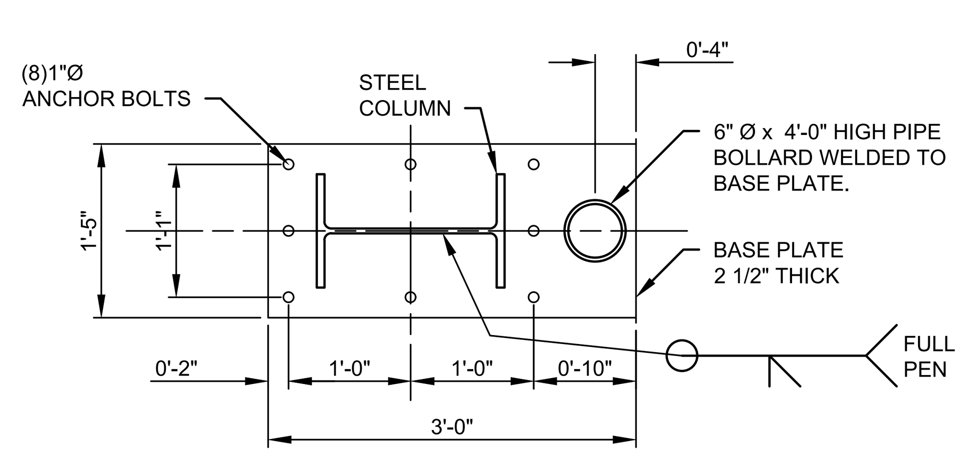
C7 IMPACT BEAM SECTION
SCALE: N.T.S.



B4 DETAIL - IMPACT BEAM BRACKETS
SCALE: N.T.S.



B7 BOTTOM RAIL DETAIL
SCALE: N.T.S.



A1 DETAIL - COLUMN BASE PLATE
SCALE: N.T.S.

GENERAL NOTES

SHEET NOTES

1. INSTALL DRAINAGE HOLES AT 1'-0" O.C. ON THE IMPACT BEAM.
2. BOLLARDS SHALL BE INSTALLED ONLY BY COLUMNS NEXT TO THE ROAD.
3. SEAL INSTALLATION HOLES ON THE GUIDE RAIL.

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MARK	DESCRIPTION	DATE

DESIGNED BY: X
DRAWN BY: X
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US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
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GALVESTON, TX 77553-1229

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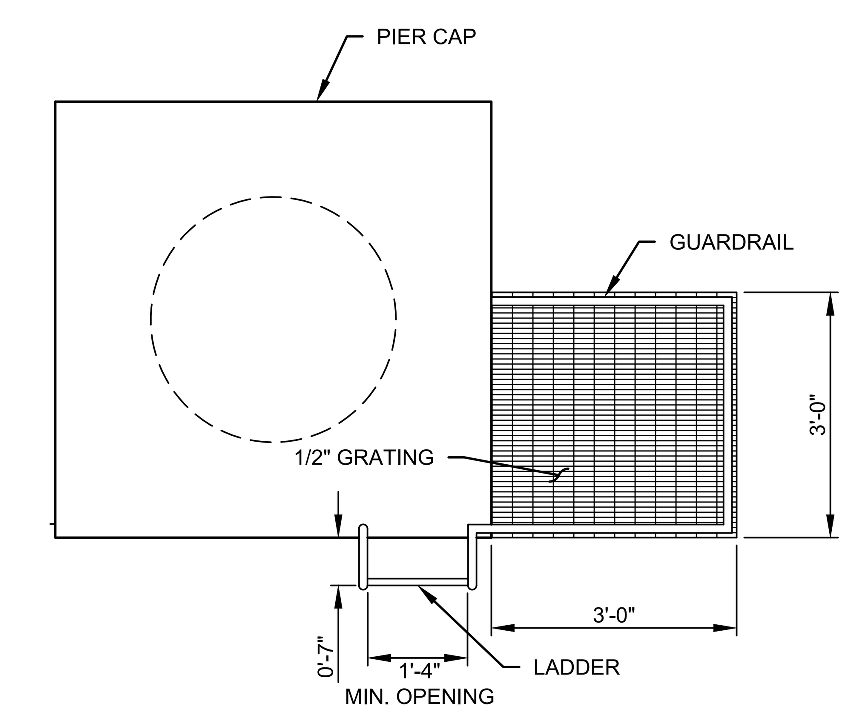
DALLAS, TX, 75252

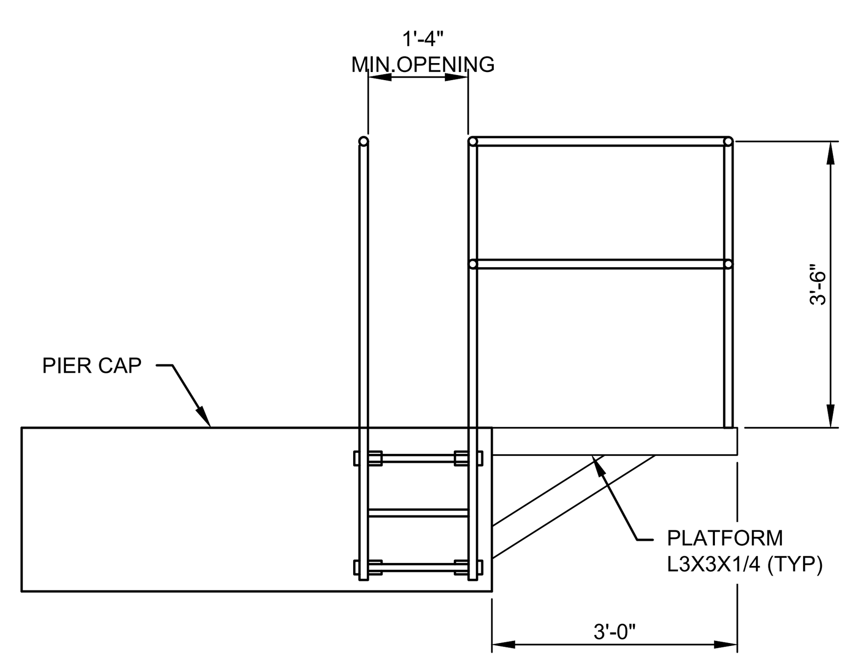
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

STRUCTURAL DETAILS

SHEET ID
RGC
S-502



E1 OPERATOR PLATFORM - PLAN
SCALE: N.T.S.



C1 OPERATOR PLATFORM - ELEVATION
SCALE: N.T.S.

GENERAL NOTES

SHEET NOTES

1. ACCESS LADDER NOT REQUIRED ON THE SITE IF DIFFERENCE BETWEEN TOP OF PIER CAP AND GRADE IS 1'-0" OR LESS.
2. CONTRACTOR TO DESIGN OPERATOR PLATFORM WHERE REQUIRED.

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MARK	DESCRIPTION	DATE

DESIGNED BY: X
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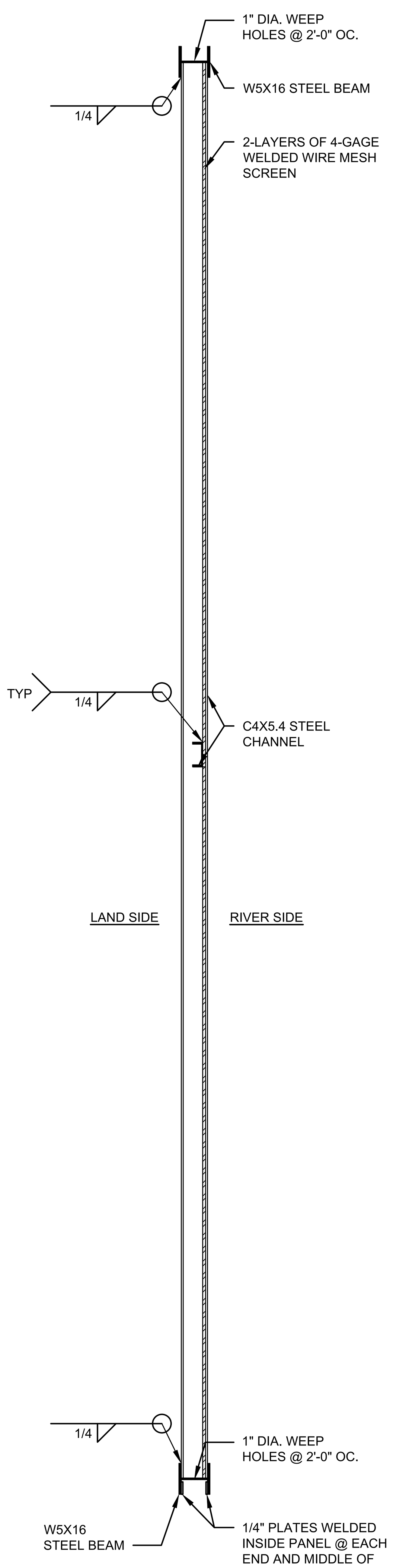
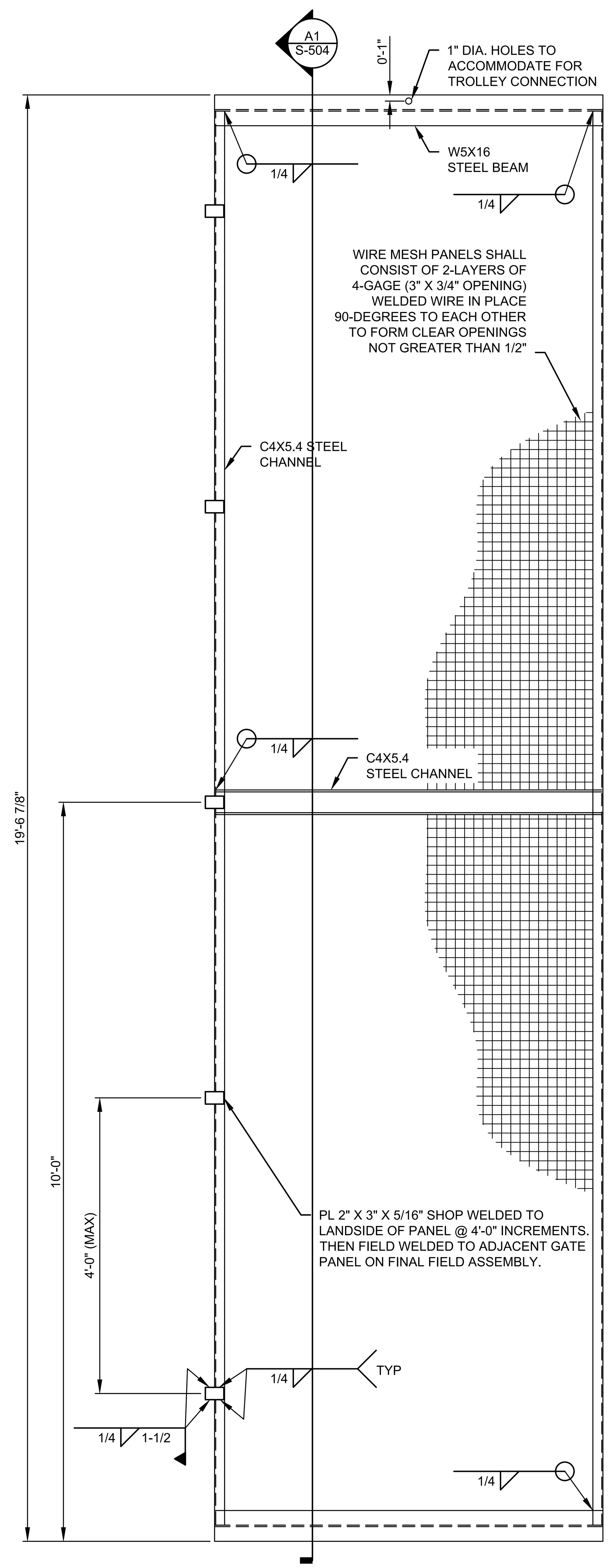
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

STRUCTURAL DETAILS

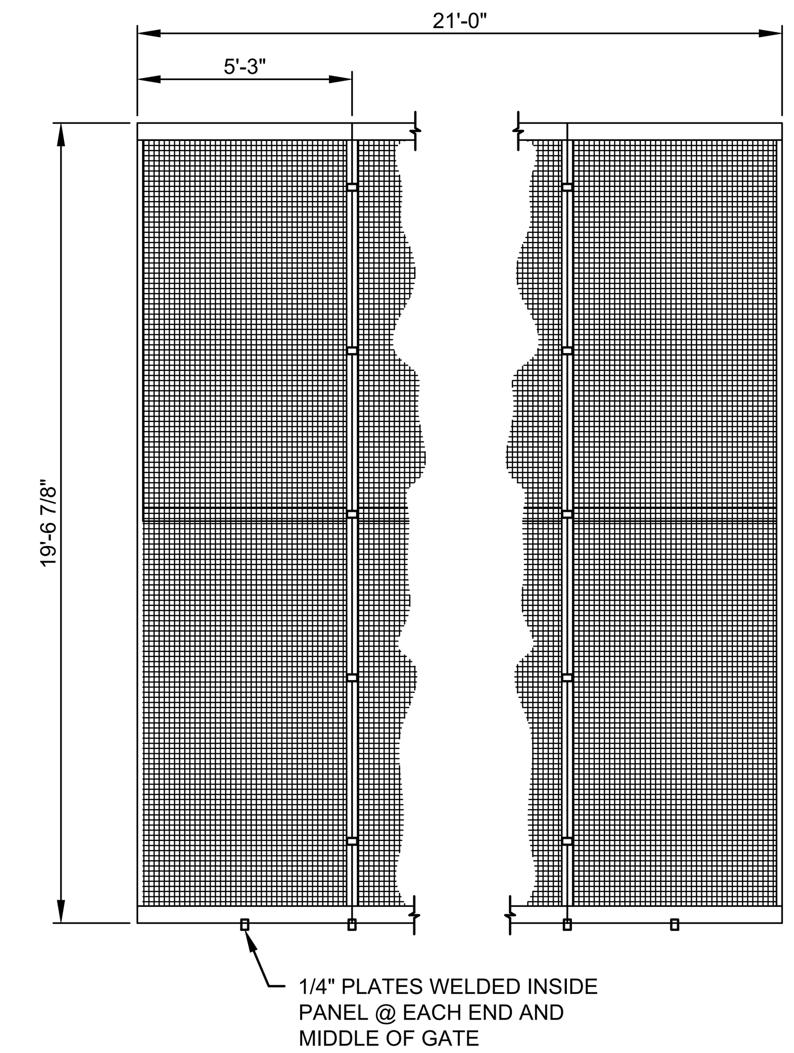
SHEET ID
RGC
S-503



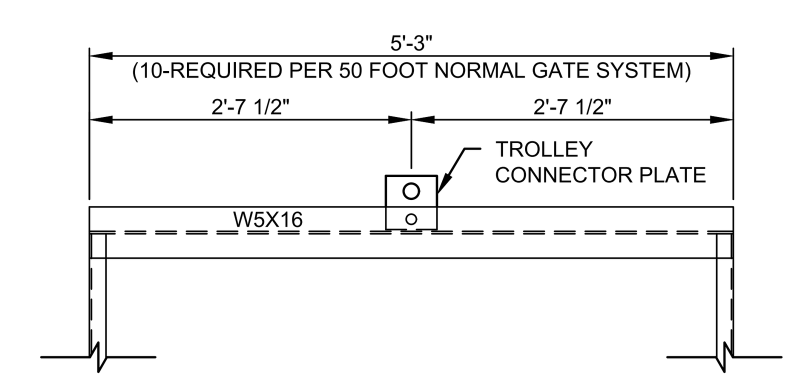
A1 SECTION
SCALE: N.T.S.



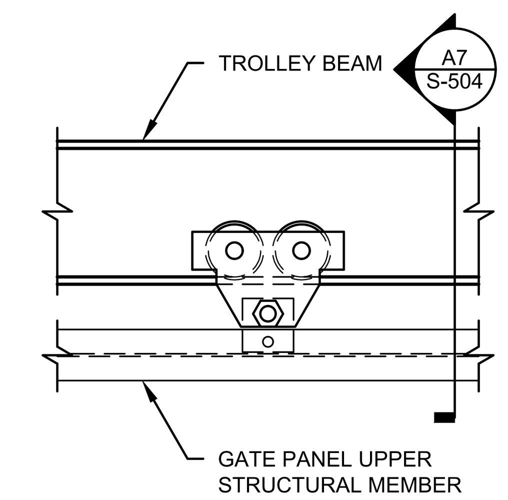
A3 ELEVATION
SCALE: N.T.S.



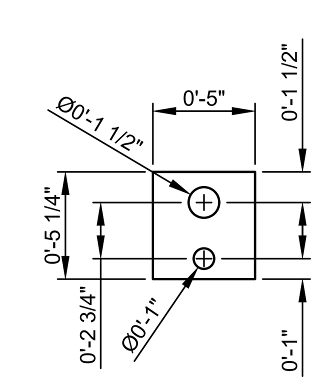
E5 ELEVATION - WIRE MESH GATES (TYP.)
SCALE: N.T.S.



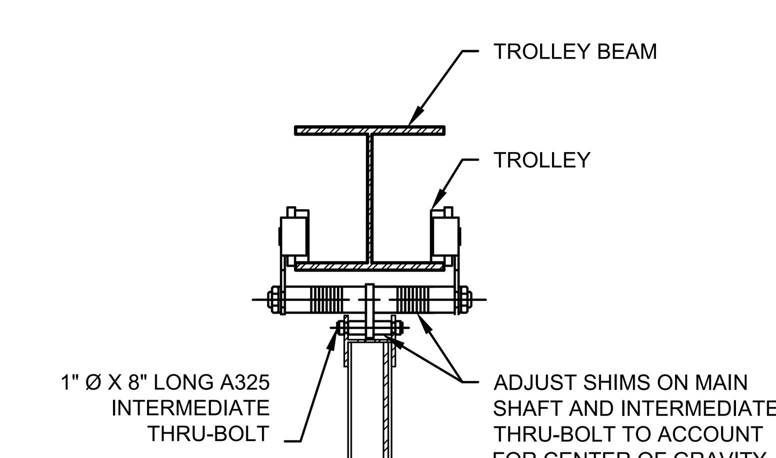
C5 DETAIL - TROLLEY CONNECTOR PLATE
SCALE: N.T.S.



C7 DETAIL - TROLLY CONNECTION
SCALE: N.T.S



A5 DETAIL - TROLLEY CONNECTOR PLATES
SCALE: N.T.S.



A7 SECTION THROUGH TROLLEY
SCALE: N.T.S.

GENERAL NOTES

SHEET NOTES

1. JOIN COMPLETED PANELS TOGETHER IN FIELD USING WELD PLATES AND STITCH WELDS AS SHOWN.
2. AFTER GATE PANELS ARE ASSEMBLED, ATTACH OPERATOR GUIDE RAIL, IMPACT BEAM, AND OTHER APPURTENANCES IN THEIR APPROPRIATE POSITIONS FOR OPERATION.
3. REFER TO ELECTRIC AND CONTROL SCHEMATICS, FOR ATTACHMENT OF OTHER CONTROLS.
4. THE MESH SHALL BE POSITIONED SUCH THAT ONLY 3/4" ON CENTER VERTICAL BARS ARE PLACED ON THE RIVER SIDE.
5. STEEL FASTENERS SHALL CONFORM TO ASTM F3125 AND ASTM A325, AND SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION.
6. THE CONNECTOR PLATE DETAILED ON DETAIL A5 SHALL BE FABRICATED AND USED IN LIEU OF THE TROLLEY MANUFACTURER'S CONNECTOR PLATE.
7. CONNECTOR PLATE SHALL BE BOLTED TO THE UPPER FRAMING MEMBER OF THE PANELS.
8. WELDING SCHEME FOR DOUBLE LAYER 4-GAGE WIRE MESH:
   - VERTICAL COMPONENT OF WIRE MESH SHALL BE POSITIONED FACING RIVER SIDE.
   - WIRE MESH LAYERS SHALL BE SPOT-WELDED TO EACH OTHER ON APPROXIMATE 12" CENTERS, OR AS REQUIRED TO PREVENT WARPING.
   - WIRE MESH LAYERS SHALL BE WELDED TOGETHER AND AT THE GATE PANEL PERIMETER ON APPROXIMATE 12" CENTERS, OR AS REQUIRED TO PREVENT WARPING.
   - WIRE MESH SHALL ALSO BE WELDED TO C4X5.4 CROSS-FRAMING AT 12" CENTERS TOP AND BOTTOM OF CHANNEL.
9. INSTALL ONE TROLLEY PER PANEL.

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MARK	DESCRIPTION	DATE

DESIGNED BY: X | DRAWN BY: X | CHECKED BY: X | SUBMITTED BY: X | SIZE: ANSI D
ISSUED DATE: | SOLICITATION NO: | CONTRACT NO.: | FILE NUMBER:

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
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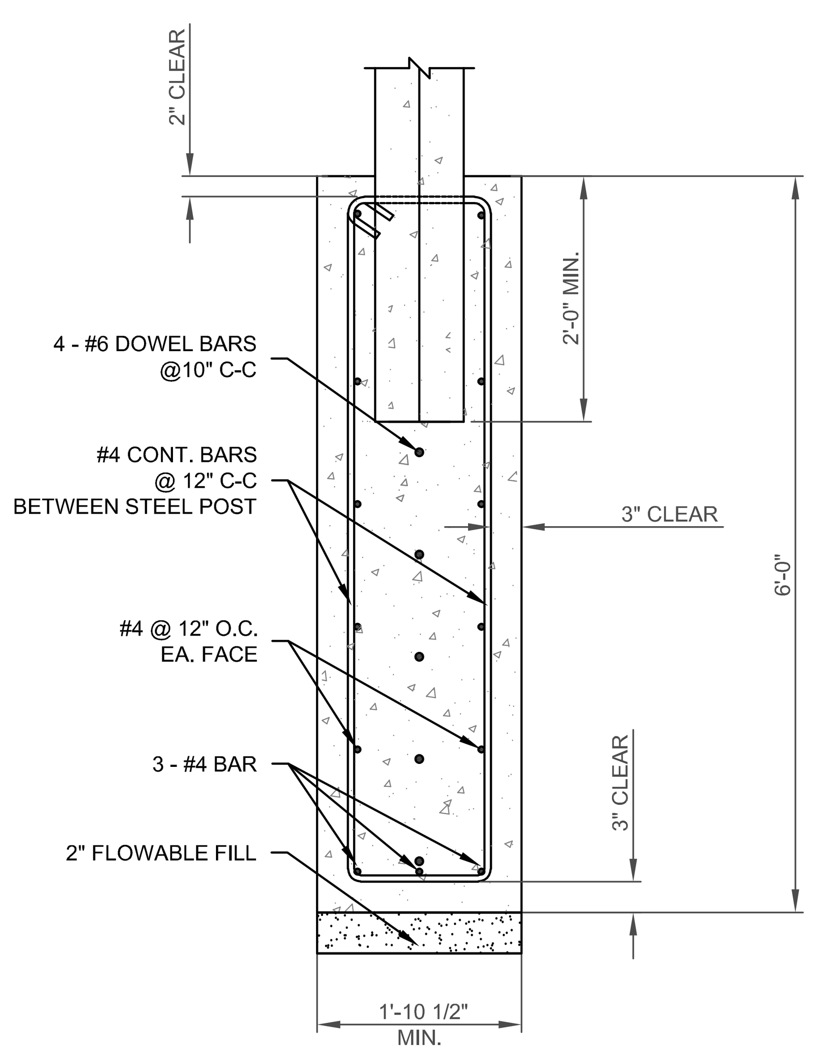
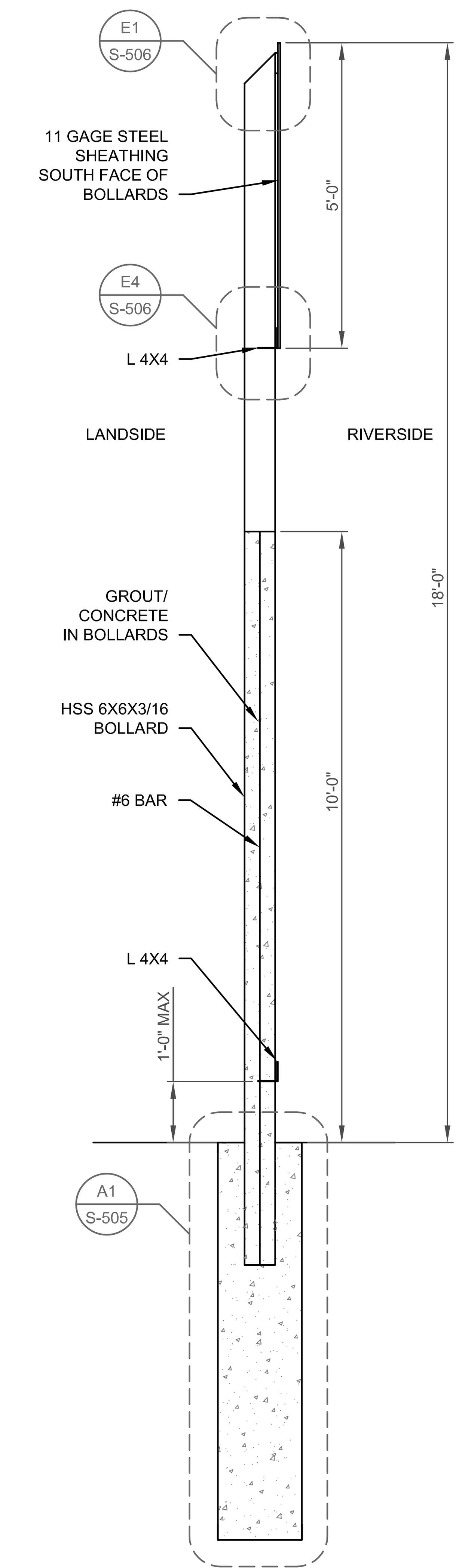
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE
WIRE MESH PANEL DETAILS

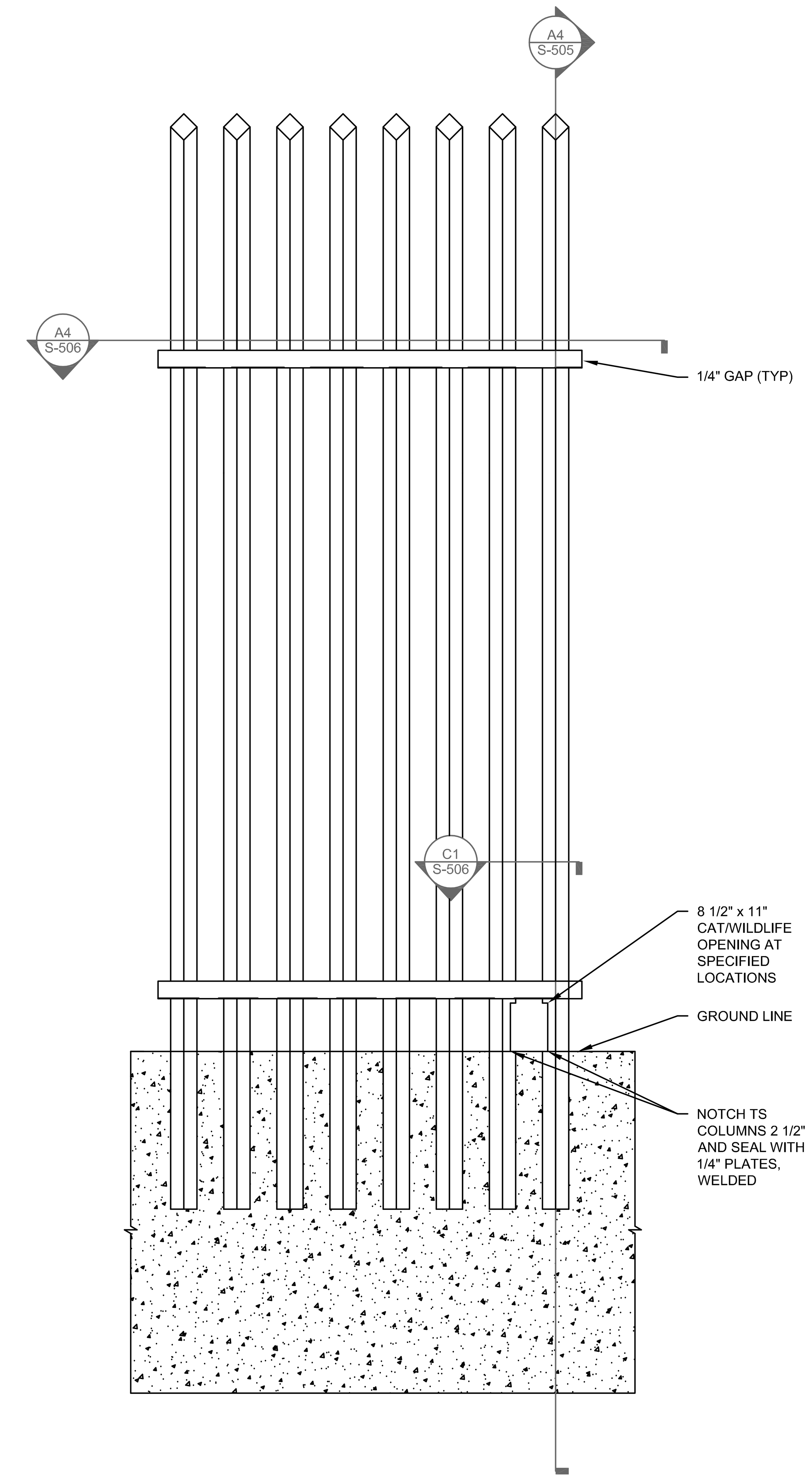
SHEET ID
RGC
S-504



A1 BOLLARD FENCE FOUNDATION
SCALE: N.T.S.



A4 BOLLARD FENCE SECTION
SCALE: N.T.S.



A7 TYPICAL 8' SECTION BOLLARD FENCE
SCALE: N.T.S.

GENERAL NOTES

1. 6" MIN. CLR. REQUIRED BETWEEN BOTTOM OF HSS & BOTTOM OF FOUNDATION.
2. CONCRETE TO BE 4000 PSI.
3. STEEL BOLLARDS SHALL BE ASTM A500 GRADE B. REFERENCE TECHNICAL SPECIFICATIONS FOR ALL OTHER MATERIAL REQUIREMENTS NOT PROVIDED IN THE DRAWINGS.
4. PLACE A 2" (MIN) FLOWABLE FILL MUD-MAT AFTER EXCAVATION FOR THE BOLLARD FENCE FOUNDATION. MUD MAT TO ACT AS A LEVELING PAD FOR THE FOUNDATION.
5. AT LOCATIONS DIRECTED BY CBP, NOTCH TWO ADJACENT BOLLARDS 2 1/2" TO HEIGHT REQUIRED TO PROVIDE 8 1/2" x 11" CAT OPENING.
6. BOLLARD FILLER FENCE WILL BE SUPPORTED ON A 6-FOOT-DEEP FOUNDATION. THE FINAL REPORT WILL PROVIDE FOOTING BEARING AND SUBGRADE PREPARATION CRITERIA FOR SUPPORT ON STIFF, LEAN AND FAT, CLAYEY NATIVE SOILS, WHICH WILL LIKELY INCLUDE 1) AN ALLOWABLE BEARING PRESSURE OF 2,000 PSF; 2) CLEANING OF LOOSENED OR SLOUGHED SOILS PRIOR TO CONCRETE PLACEMENT; 3) REVIEW OF PREPARED BEARING SURFACES PRIOR TO REINFORCING STEEL AND CONCRETE PLACEMENT; AND 4) PLACEMENT OF A MINIMUM 2" THICK CONCRETE MUD MAT IMMEDIATELY FOLLOWING BEARING SURFACE REVIEW AND PRIOR TO REINFORCING STEEL PLACEMENT IN ORDER TO LIMIT ANY CHANGES IN THE IN-SITU SUBGRADE MOISTURE CONTENT.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

DESIGNED BY: B.PRESTON
DRAWN BY: B.DUNNE
CHECKED BY: B.PRESTON
SUBMITTED BY: B.PRESTON
SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
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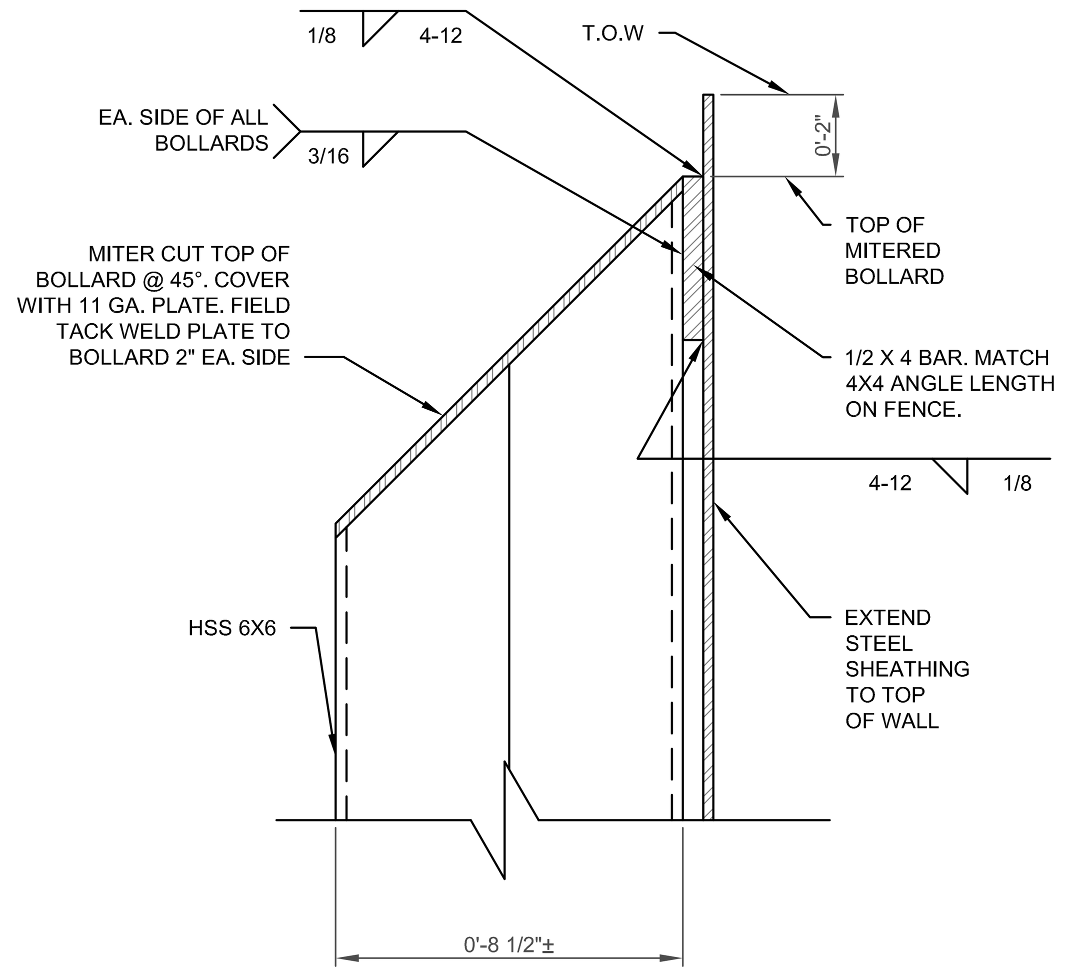
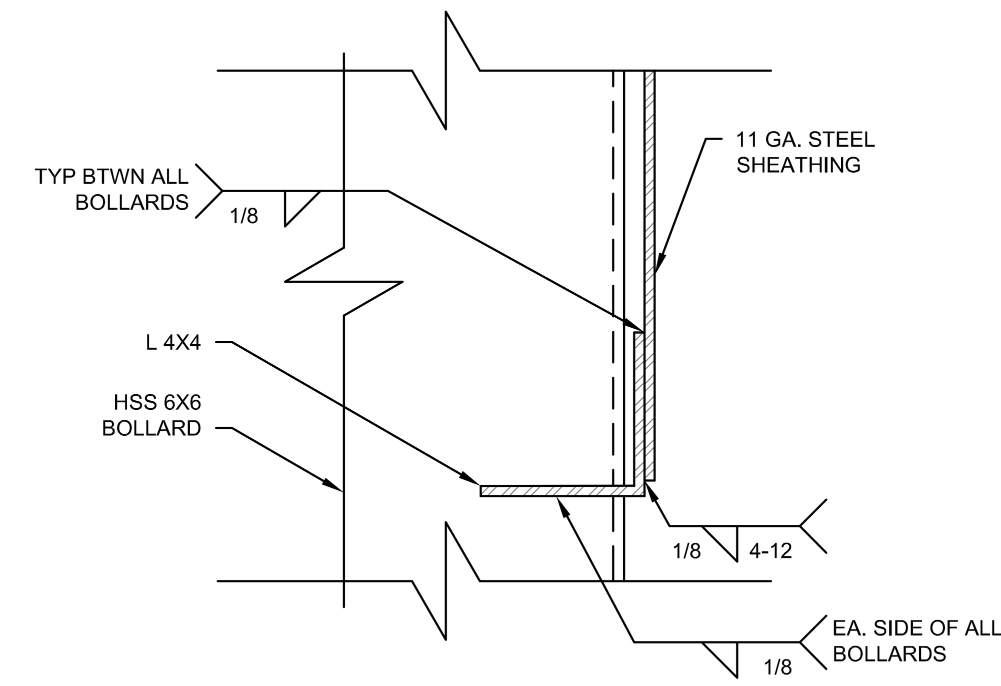
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

FENCE DETAILS
20 FT. FENCE

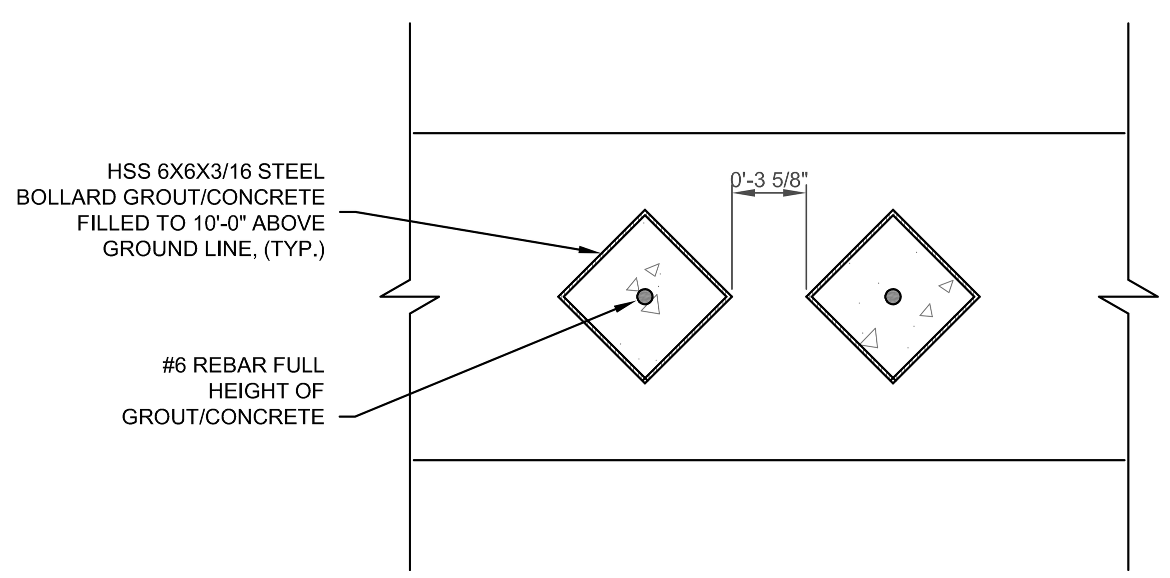
SHEET ID
RGC
S-505



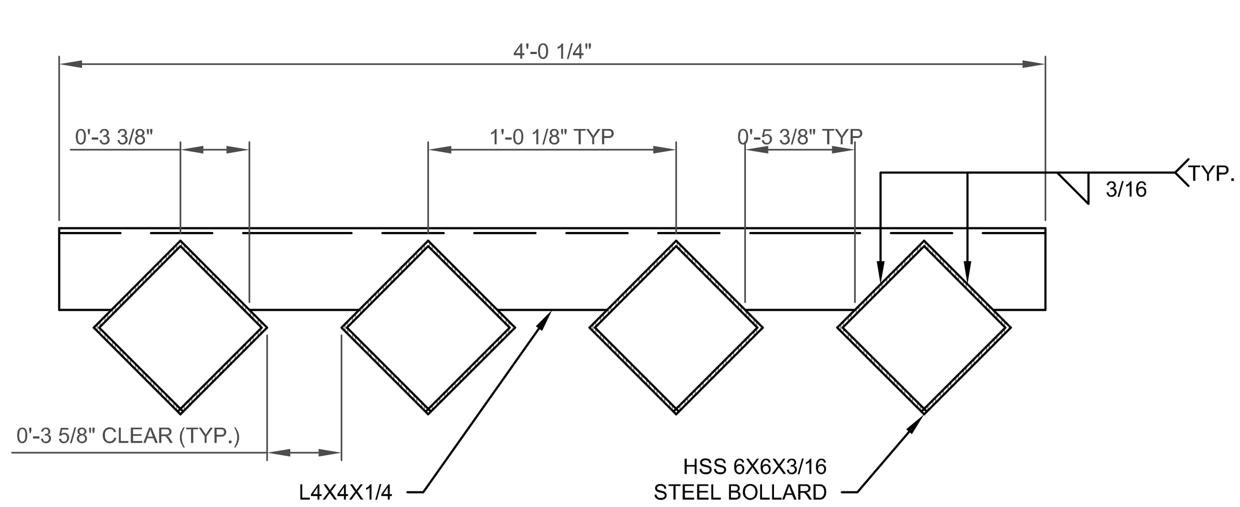
E1 TOP OF FENCE DETAIL
SCALE: N.T.S.



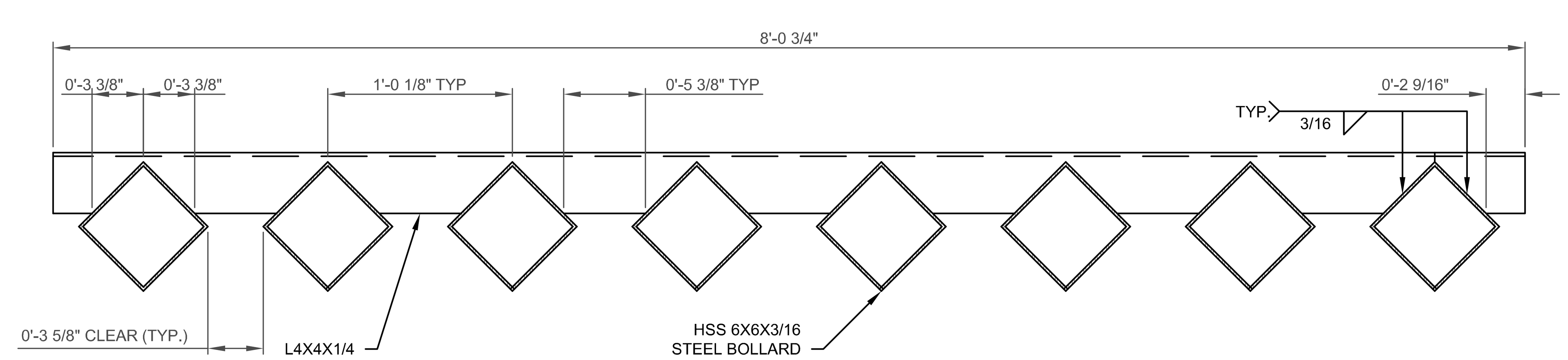
E4 BOTTOM OF SHEATHING DETAIL
SCALE: N.T.S.



C1 BOLLARD FENCE DETAIL
SCALE: N.T.S.



A1 BOLLARD FILLER FENCE
SCALE: N.T.S.



A4 BOLLARD FENCE
SCALE: N.T.S.

GENERAL NOTES

1. 6" MIN. CLR. REQUIRED BETWEEN BOTTOM OF HSS & BOTTOM OF FOUNDATION.
2. CONCRETE TO BE 4000 PSI.
3. STEEL BOLLARDS SHALL BE ASTM A500 GRADE B. REFERENCE TECHNICAL SPECIFICATIONS FOR ALL OTHER MATERIAL REQUIREMENTS NOT PROVIDED IN THE DRAWINGS.

XX

US Army Corps of Engineers ®

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DESIGNED BY: B.PRESTON
DRAWN BY: B.DUNNE
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US ARMY CORPS OF ENGINEERS
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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

FENCE DETAILS
20 FT. FENCE

SHEET ID
RGC
S-506

ONE-LINE AND RISER

- KVA,CLG / HV-LV / Z — POWER TRANSFORMER
- AMP — LOW VOLTAGE CIRCUIT BREAKER, DRAWOUT:
  - E.O. = ELECTRICALLY OPERATED
  - G = GROUND
  - I = INSTANTANEOUS
  - IA = INSTANTANEOUS AMPS
  - LT = LONG TIME
  - M.O. = MANUALLY OPERATED
  - ST = SHORT TIME
  - S = SENSOR RATING
- A — MOLDED CASE CIRCUIT BREAKER
- AF — MEDIUM VOLTAGE CIRCUIT BREAKER, DRAWOUT
- MINIATURE CIRCUIT BREAKER
- AMP / FUSE — FUSED CUT-OUT SWITCH
- AMP / AMP — FUSED DISCONNECT SWITCH
- AMP — NON-FUSED DISCONNECT SWITCH
- AF / AT / SIZE — COMBINATION CIRCUIT BREAKER WITH STARTER:
  - FVNR = FULL VOLTAGE NON-REVERSING
  - FVR = FULL VOLTAGE REVERSING
  - 2S = TWO SPEED
  - 1W = ONE WINDING
  - 2W = TWO WINDING
  - C = CONTACTOR
  - SFT = SOFT START
- AMP / FUSE — MEDIUM VOLTAGE MOTOR STARTER
- PANELBOARD
- TRANSFER SWITCH (AUTOMATIC OR MANUAL)
- CONVERTER OR VFD — * = ~ = AC, - = DC
- HP — MOTOR
- GEN — KW / KVA / PF / Z — GENERATOR
- LOCAL CONTROL:
  - CP = CONTROL PANEL
  - HTR = HEATER
  - SKD = SKID MOUNTED LOAD
  - VFD = VARIABLE FREQUENCY DRIVE
  - HOA = HAND/OFF/AUTO
- KV / MCOV — SURGE ARRESTOR
- AMP — FUSE
- BATTERY
- OPEN DELTA
- IMPEDANCE GROUNDED WYE
- GROUND
- DELTA
- SOLID GROUNDED WYE
- MULTIFUNCTION RELAY OR METER (* NOTE 5)
- (QTY) PRI:SEC ACCUR — VOLTAGE TRANSFORMER
- (QTY) PRI/SEC ACCUR — CURRENT TRANSFORMER
  - INDICATES POLARITY
- PRI/SEC ACCUR — CURRENT TRANSFORMER, ZERO SEQUENCE
- WH — WATT HOUR METER

RACEWAY AND LINE TYPES

- CONDUIT STUB WITH CAP
- CONDUIT:
  - EMBEDDED
  - EXPOSED
  - UNDERGROUND DIRECT BURIAL
- C — CONDUIT TURN-DOWN
- CONDUIT TURN-UP
- J — JUNCTION BOX
- BUS
- POWER CIRCUIT
- CT & VT CIRCUIT
- CONTROL CIRCUIT
- COMMUNICATION
- ELECTRICAL ENCLOSURE
- E_X — EXISTING OVERHEAD ELECTRICAL LINES
- NEW UNDERGROUND COMMUNICATIONS DUCTBANK
- NEW UNDERGROUND ELECTRICAL DUCTBANK
- INDICATES CABLE NUMBER
- HOME RUN CONDUIT - SHORT STROKES INDICATE PHASE OR SWITCHED WIRES, LONG STROKES INDICATE NEUTRAL, LONG STROKES WITH DOT INDICATE GROUND CONDUCTORS, LONG STROKES WITH TICK INDICATE ISOLATED GROUND

PLAN VIEW

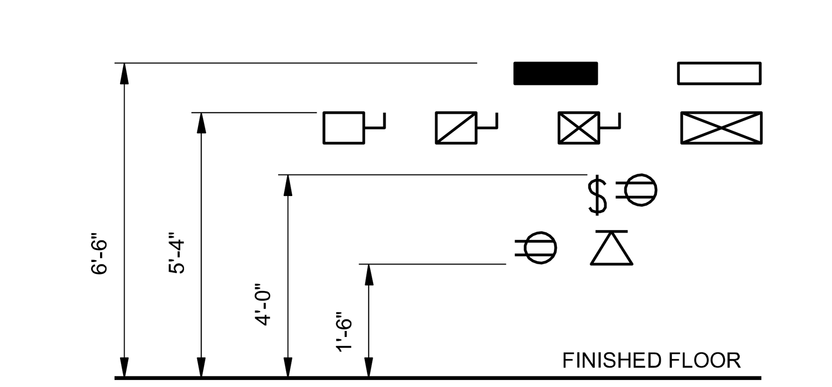
- T — TRANSFORMER
- NON-FUSED DISCONNECT SWITCH
- FUSED DISCONNECT SWITCH
- COMBINATION DISCONNECT WITH STARTER
- $ HP — HORSEPOWER RATED DISCONNECT SWITCH
- PANELBOARD, 480Y/277V OR 480V
- PANELBOARD, 208Y/120V OR 120/240V
- SERVICE ENTRANCE METER
- XFR — TRANSFER SWITCH (AUTOMATIC OR MANUAL)
- M — MOTOR
- GEN — GENERATOR
- LOCAL CONTROL PANEL
- SPECIAL PURPOSE RCPT OR CONNECTION, 480V
- SPECIAL PURPOSE RCPT OR CONNECTION, 240V
- MH — MANHOLE
- HH — HANDHOLE
- SINGLE RECEPTACLE
- DUPLEX RECEPTACLE
- FOURPLEX RECEPTACLE
- J — SURFACE RACEWAY (WIREMOLD)
- COIL

LIGHTING

(SEE NOTE 3)

- X — LED BOLLARD LIGHT
- X — HID/INCANDESCENT, WALL MOUNTED
- X — HID/INCANDESCENT, POLE MOUNTED
- EMERGENCY BATTERY OPERATED UNIT

ELECTRICAL DEVICE MOUNTING HEIGHT



LIGHTING CONTINUED

- EXIT SIGN, SINGLE FACE, CEILING MOUNT
- EXIT SIGN, DOUBLE FACE, CEILING MOUNT
- EXIT SIGN, ARROW INDICATES DIRECTION
- WALL MOUNT
- LIGHTING CONTROL:
  - LC = LIGHTING CONTACTOR
  - OC = OCCUPANCY SENSOR
  - PE = PHOTOELECTRIC CELL
  - TC = TIME CLOCK
  - C = CONTACTOR
  - PSR = PHOTO SENSOR - RECEIVER
  - PST = PHOTO SENSOR - TRANSMITTER
- $ — SWITCH, SINGLE POLE
- $ * — SWITCH:
  - 3 = THREE-WAY
  - 4 = FOUR-WAY
  - D = DIMMER
  - K = KEY OPERATED
  - P = PILOT
  - a,b,c = DENOTES SWITCHING CONTROL
- PS — SAFETY PHOTO SENSOR
- ML — MAGLOCK
- KP — SECURITY KEYPAD

COMMUNICATION

- TEL — TELEPHONE PANEL
- TTB — TELEPHONE TERMINAL BOARD
- AMP — AMPLIFIER
- CCTV SURVEILLANCE CAMERA, FIXED
- CCTV SURVEILLANCE CAMERA, PAN/ZOOM/TILT
- WALL MOUNT

GROUNDING

- GROUND CONDUCTOR
- LIGHTNING PROTECTION CONDUCTOR
- GROUND
- GROUND ROD
- LIGHTNING PROTECTION AIR TERMINAL
- LIGHTNING PROTECTION SPHERE
- THROUGH ROOF TERMINAL
- GROUNDING CONNECTION TO STRUCTURE
- FLUSH GROUND PLATE
- GROUND CONDUCTOR CONNECTION
- GROUNDING PIGTAIL

GENERAL NOTES

1. ALL SYMBOLS AND ABBREVIATIONS SHOWN ON THIS LEGEND MAY OR MAY NOT APPEAR ON THIS SET OF DRAWINGS.
2. FOR GENERAL LEGEND AND ABBREVIATIONS, SEE "GG" DRAWINGS.
3. X ON FIXTURE SYMBOL DENOTES FIXTURE TYPE DESIGNATION. SEE FIXTURE SCHEDULE.
4. USE DIRECTIONAL ARROW ON EXIT SIGNS AS REQUIRED.
5. IEEE STANDARD C37.2-1991, ELECTRICAL POWER SYSTEM DEVICE FUNCTION NUMBERS.

ELECTRICAL ABBREVIATIONS

NOTE: NOT ALL ABBREVIATIONS INDICTED MAY APPEAR ON THESE DRAWINGS

ABOVE FINISH FLOOR	AFF
ABOVE FINISHED GRADE	AFG
ACCENT	ACC
ADJUSTABLE	ADJ
ALTERNATING CURRENT	AC
ALUMINUM	AL
AMERICAN WIRE GAUGE	AWG
AMMETER	AM
AMPERE	A/AMP
APPROXIMATE(LY)	APPROX
ASYMMETRIC	ASY
AUTOMATIC TRANSFER SWITCH	ATS
BATTERY	BATT
BLACK	BLK
BRACKET	BRKT
BREAKER	BKR
CABINET	CAB
CABLE TELEVISION	CATV
CEILING	CLG
CIRCUIT	CKT
CIRCUIT BREAKER	CKT BKR
CLEAR	CLR
CLOSED CIRCUIT TELEVISION	CCTV
COLUMN	COL
COMMUNICATION	COMM
CONDUIT	C
COOL WHITE	CW
COPPER	CU
CURRENT LIMITING FUSE	CLF
CURRENT TRANSFORMER	CT
DECIBEL	DB
DEDICATED	DED
DIAMETER	DIA
DIRECT CURRENT	DC
DISCONNECT	DISC
DISTRIBUTION PANEL	DP
DOUBLE POLE DOUBLE-THROW	DPDT
DOWNLIGHT	DNLT
DRAWING	DWG
DUAL ELEMENT	DE
EACH	EA
ELECTRIC WATER COOLER	EWC
ELECTRICAL	ELEC
ELECTRICAL CONTRACTOR	EC
ELECTRICALLY OPERATED	ED
ELEVATION	EL
ELEVATOR	ELEV
EMERGENCY LIGHTING	EM
ENERGY SAVING BALLAST	ESB
EQUIPMENT	EQUIP
EXHAUST FAN	EF
EXPLOSION PROOF	XP
FIRE ALARM	FA
FIRE ALARM ANNUNCIATOR	FAAP
PANEL	FACP
FIRE ALARM CONTROL PANEL	FAGP
FIRE ALARM GRAPHIC PANEL	ANNUN
FIRE ANNUNCIATOR PANEL	FIXT
FIXTURE	FL
FLOOR	FLUOR
FLUORESCENT	FC
FOOTCANDLES	FLA
FULL LOAD AMPERES	FVNR
FULL VOLTAGE NON-REVERSING	
GENERAL CONTRACTOR	GC
GENERATOR	GEN
GROUND	GND/G
GROUND FAULT CIRCUIT	GFCI
INTERRUPTER	
HAND DRYER	HD
HAND HOLE	HH
HEATING VENTILATING AND	
AIR CONDITIONING	HVAC
HERTZ	HZ
HIGH INTENSITY DISCHARGE	HID
HIGH POWER FACTOR	HPF
HIGH VOLTAGE	HV
HORSEPOWER	HP
INCANDESCENT	INCAN
ISOLATED GROUND	IG
JUNCTION BOX	JB OR JCT BOX
KILOVAR (REACTANCE)	KVAR
KILOVOLT AMPERE	KVA
KILOWATT	KW
KILOWATT HOUR METER	KWH
LIGHT	LT
LIGHTING	LTG
LIGHTING ARRESTOR	LA
LOW VOLTAGE	LV
MAIN CIRCUIT BREAKER	MCB
MAIN DISTRIBUTION PANEL	MDP
MAIN LUGS ONLY	MLO
MANHOLE	MH
MANUAL TRANSFER SWITCH	MTS
MANUFACTURER	MFR
MASTER ANTENNA TELEVISION	MATV
MECHANICAL CONTRACTOR	MC
MEDIUM VOLTAGE	MV
METAL HALIDE	MH
METAL-CLAD CABLE	MC
MISCELLANEOUS	MISC
MOTOR CIRCUIT PROTECTOR	MCP
MOTOR CONTROL CENTER	MCC
MOTOR OPERATED DAMPER	MOD
MOUNTED	MTD
MOUNTING HEIGHT	MTG HT
NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION	NEMA
NATIONAL ELECTRICAL CODE	NEC
NIGHT LIGHT	NL
NORMALLY CLOSED	NC
NORMALLY OPEN	NO
NOT AVAILABLE/NOT APPLICABLE	N/A
NOT FUSED	NF
NOT IN CONTRACT	NIC
NOT TO SCALE	NTS
ON CENTER	OC
OVERHEAD	OH
OVERLOAD HEATER ELEMENT	OL
PANEL	PNL
PEWTER	PEW
PLYWOOD	PLY
POLE	P
POLYVINYL CHLORIDE	PVC
POTENTIAL TRANSFORMER	PT
POWER PANEL	PP
PULL BOX	PB
RAPID START	RS
RECEPTACLE	REC/RECPT
REFLECTOR	REFL
REQUIRED	REQ'D
RIGID GALVANIZED STEEL	RGS
CONDUIT	RM
ROOM	
SCHEDULE	SCHED
SINGLE POLE DOUBLE THROW	SPDT
SINGLE POLE SINGLE THROW	SPST
SOLID STATE BALLAST	SSB
SURGE PROTECTION DEVICE	SPD
SWITCH	SW
SWITCHBOARD	SWBD
SWITCHGEAR	SWGR
TELEPHONE	TEL
TRANSFORMER	XFMR
TRANSIENT VOLTAGE SURGE SUPPRESSOR	TVSS
TWIN TUBE	TT
TYPICAL	TYP
UNDERGROUND	UG
UNDERWRITERS' LABORATORIES	UL
UNINTERRUPTIBLE POWER	UPS
SUPPLY	UON
UNLESS OTHERWISE NOTED	
VAPOR PROOF	VP
VOLT	V
VOLTMETER	VM
WARM WHITE	WW
WATT	W
WEATHERPROOF	WP
WITH	W/
WITHIN	W/I
WITHOUT	W/O

US Army Corps of Engineers ®

MARK | DESCRIPTION | DATE

ISSUED DATE: | SOLICITATION NO.: | CONTRACT NO.: | FILE NUMBER:

DESIGNED BY: M.J. HILL | DRAWN BY: D.A. NELSON | CHECKED BY: | SUBMITTED BY: | SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BARRIER FENCE
LEGEND AND ABBREVIATIONS

SHEET ID
RGC
E-001

LIGHTING GENERAL NOTES

1. THESE PLANS ARE INTENDED TO DEPICT THE LIGHT FIXTURE POLE LAYOUT, CIRCUITING REQUIREMENTS, PHOTOMETRIC REQUIREMENTS, AND OTHER GENERAL REQUIREMENTS FOR THE LIGHT FIXTURES TO BE USED.
2. THE INTENT OF THE LIGHTING DESIGN IS A PERFORMANCE SPECIFICATION, DESIGNED TO GIVE SPECIFIC REQUIREMENTS FOR THE PERFORMANCE OF THE LIGHT FIXTURES. REFERENCE SPECIFICATIONS FOR ALL REQUIREMENTS. ANY MANUFACTURER MEETING ALL REQUIREMENTS WILL BE CONSIDERED ACCEPTABLE.
3. THE LIGHT FIXTURES FOR GENERAL ENFORCEMENT ZONE ILLUMINATION MUST MEET THE FOLLOWING PHOTOMETRIC REQUIREMENTS WITHIN THE ENFORCEMENT ZONE, AT THE LIGHT POLE HEIGHTS AND SPACING INDICATED ON THE PLANS (IN ADDITION TO OTHER REQUIREMENTS ON THE PLANS AND SPECIFICATIONS):
   - AVERAGE OF 3 HORIZONTAL FOOTCANDLES AT GRADE ACROSS THE ENTIRE ENFORCEMENT ZONE BOUNDARY INDICATED ON THE PLANS, WHICH RANGES FROM 50-150 FEET FROM THE BORDER FENCE AS SHOWN ON THE PLANS.
   - -MAXIMUM TO MINIMUM FOOTCANDLE RATIO OF 20 TO 1 WITHIN THE ENFORCEMENT ZONE.
   - -LIGHT TRESPASS BEYOND THE ENFORCEMENT ZONE SHALL BE LIMITED TO 0.5 FOOTCANDLES, AND SHALL TAPER TO BELOW 0.1 FOOTCANDLES AT A MAXIMUM OF 75 FEET BEYOND THE ENFORCEMENT ZONE BOUNDARY.
4. THE LIGHT FIXTURES AT THE VEHICULAR GATES MUST MEET THE FOLLOWING PHOTOMETRIC REQUIREMENTS WITHIN THE GATE AREAS, AT THE MOUNTING HEIGHT AND LOCATIONS INDICATED ON THE PLANS (IN ADDITION TO OTHER REQUIREMENTS ON THE PLANS AND SPECIFICATIONS):
   - ILLUMINATE A PERIMETER OF 100 FEET BY 100 FEET, CENTERED ON THE MIDDLE OF THE GATE TO A MINIMUM OF 2 FOOT CANDLES AT THE GROUND LEVEL.

MEDIA CONVERTER GENERAL NOTES

1. MEDIA CONVERTER SHALL BE CAPABLE OF (2) INDEPENDENT FIBER OPTIC INPUTS AND (1) PoE COPPER CABLING OUTPUT. MEDIA CONVERTER SHALL AUTOMATICALLY TRANSFER BETWEEN FIBER OPTIC INPUTS AS AVAILABLE.
2. MEDIA CONVERTERS SHALL BE POWERED UTILIZING STANDARD 110V ELECTRICAL OUTLET.

GROUNDING GENERAL NOTES

1. FENCE GROUNDING, WHERE INDICATED ON THE PLANS, SHALL CONSIST OF 3/4" X 10' GROUND ROD PER SPECIFICATIONS, WITH THE TOP OF GROUND ROD A DRIVEN A MINIMUM OF 6" BELOW THE TOP OF FINISHED GRADE. CONNECT AND BOND #6 CONDUCTOR FROM GROUND ROD TO FENCE BOLLARD AT LOCATIONS INDICATED ON PLANS. ENSURE THAT BOLLARD FENCING IS ELECTRICALLY CONTINUOUS THROUGH EITHER WELDED PLATE OR CONCRETE ENCASED REINFORCING STEEL.
2. ALL GROUNDING SHALL BE IN STRICT COMPLIANCE WITH ARTICLE 250 OF THE 2017 NATIONAL ELECTRICAL CODE.

TRANSFER SWITCH GENERAL NOTES

1. MANUAL TRANSFER SWITCHES LOCATED AT THE VEHICLE GATES AND UTILITY CONNECTION POWER DISTRIBUTION POINTS SHALL INCLUDE CAM-LOCK STYLE CONNECTORS FOR QUICK CONNECTION OF PORTABLE GENERATORS.

CAMERA INFRASTRUCTURE NOTES

1. THE INTENT OF THIS PROJECT IS TO INCLUDE THE NECESSARY INFRASTRUCTURE FOR FUTURE SECURITY CAMERA CONNECTIONS AT LIGHT POLES ALONG THE ENFORCEMENT ZONE BOUNDARY. CAMERAS, CAMERA MOUNTS, AND COPPER CABLING TO THE POLE MOUNTED CAMERAS FROM THE CAMERA BOXES AT THE BASE OF THE LIGHT POLES WILL BE PROVIDED AND INSTALLED BY OTHERS AS PART OF A FUTURE PROJECT. THIS PROJECT INCLUDES ONLY THE CONDUIT INFRASTRUCTURE TO THE LIGHT POLES, THE CAMERA BOXES AS DETAILED AT EVERY 6TH LIGHT POLE, AND THE MEDIA CONVERTERS WITHIN THE CAMERA BOXES.

MINI-POWER CENTER GENERAL NOTES

1. EACH MINI-POWER CENTER AS INDICATED ON THESE PLANS SHALL BE ENCLOSED IN A WEATHERPROOF NEMA 4X ENCLOSURE, AND SHALL STEP THE VOLTAGE DOWN FROM 480V TO 120/240V, SINGLE PHASE. EACH MINI-POWER CENTER SHALL HAVE A MINIMUM INTEGRATED 3KVA TRANSFORMER WITHIN THE ENCLOSURE, AS WELL AS TRANSFORMER PRIMARY CIRCUIT BREAKER AND (8) 20A/1P SECONDARY CIRCUIT BREAKERS, FOR 120V FEEDERS TO CAMERA MEDIA CONVERTER ENCLOSURES.

GATE GENERAL NOTES

1. PROVIDE COMMUNICATIONS AND ELECTRICAL HANDHOLE AT EACH GATE.
2. PROVIDE COMMUNICATIONS, POWER, AND CONTROLS AT EACH GATE PER DRAWINGS E-503 AND E-603

ELECTRICAL GENERAL NOTES

1. THESE PLANS ARE SCHEMATIC. THE CONTRACT DOCUMENTS CREATED BY THIS OFFICE ARE DIAGRAMMATIC AND SHOW THE INTENTION OF THIS PROJECT TO INSTALL NEW EQUIPMENT AND ASSOCIATED MATERIALS. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS PRIOR TO BID.
2. ALL ELECTRICAL WORK IS REQUIRED TO BE PERFORMED BY A CERTIFIED ELECTRICAL CONTRACTOR. ALL WIRING, EQUIPMENT, DEVICES AND INSTALLATIONS SHALL CONFORM TO ALL APPLICABLE LOCAL, STATE AND FEDERAL CODES.
3. PROVIDE ALL WIRING, CONDUIT, LABOR AND MATERIALS NOT SHOWN ON PLAN, BUT NECESSARY FOR COMPLETE AND PROPER OPERATION OF THE ELECTRICAL SYSTEM.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL FEES AND PERMITS AS NECESSARY TO COMPLETE THIS JOB. CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS AND EQUIPMENT NECESSARY TO ENSURE A COMPLETE WORKING SYSTEM.
5. ALL ELECTRICAL WORK MUST COMPLY WITH THE REQUIREMENTS OF NFPA 70 (NATIONAL ELECTRICAL CODE), NFPA 70B, NFPA 70E, IECC, OSHA IN ADDITION TO OTHER REFERENCES REQUIRED BY CONTRACT.
6. INSTALLATION OF SWITCHES, OUTLETS AND CONTROL DEVICES SHALL COMPLY WITH LOCAL CODES AND STATE ADA REQUIREMENTS.
7. REFER TO CIVIL PLANS FOR EXACT LOCATIONS OF ALL EQUIPMENT.
8. ALL ELECTRICAL EQUIPMENT, DEVICES AND CIRCUITS SHALL CONTAIN A GROUNDING CONDUCTOR. CONDUIT SYSTEM SHALL NOT BE USED AS GROUNDING NETWORK. ALL GROUNDING SHALL BE IN STRICT COMPLIANCE WITH ARTICLE 250 OF THE NATIONAL ELECTRICAL CODE.
9. COORDINATE LOCATION AND VERIFY REQUIREMENTS OF ALL EXTERIOR UTILITY EQUIPMENT AND METER BASE WITH OWNER AND UTILITY COMPANY. UTILITY PROVIDER FOR THE PROJECT IS A.E.P. CONTRACTOR RESPONSIBLE FOR PROVIDING UTILITY SERVICE PROVIDER WITH LOAD FORMS AND ALL INFORMATION REQUIRED FOR NEW SERVICE INSTALLATION PER UTILITY COMPANY STANDARDS. COORDINATE WITH UTILITY COMPANY FOR EXACT SERVICE POINT, POLE, AND TRANSFORMER LOCATIONS.
10. UTILITY SECONDARY TRENCH AND CONDUIT REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE UTILITY COMPANY SPECIFICATIONS. COORDINATE WITH UTILITY COMPANY. PROVIDE AND INSTALL ALL MATERIAL AND EQUIPMENT AS REQUIRED FOR COMPLETE JOB INSTALLATION.
11. ALL SWITCHBOARDS, PANELBOARDS, TRANSFORMERS, DISCONNECT SWITCHES AND OTHER ELECTRICAL DEVICES AND EQUIPMENT SHALL HAVE ENGRAVED NAMEPLATES INDICATING EQUIPMENT IDENTIFICATION TAG AND VOLTAGE, AS WELL AS WHERE DEVICE IS FED FROM. ALL SWITCHBOARDS AND PANELBOARDS SHALL HAVE TYPED DIRECTORIES INDICATING DISTRIBUTION AND BRANCH CIRCUIT FEEDERS.
12. CONTRACTOR IS RESPONSIBLE FOR NATIONAL ELECTRICAL CODE REQUIRED CLEARANCES AROUND AND ABOVE ALL ELECTRICAL EQUIPMENT AND DEVICES.
13. SHORT CIRCUIT AMPERE INTERRUPTING CAPACITY (A.I.C.) RATING OF ALL ELECTRICAL PRODUCTS SHALL BE GREATER THAN THE MAXIMUM AVAILABLE SHORT CIRCUIT CURRENT.
14. WIRE AND CONDUIT SIZES SHALL BE INSTALLED AND SIZED TO COMPENSATE FOR VOLTAGE DROP PER THE NATIONAL ELECTRICAL CODE.
15. ALL ELECTRICAL AND ELECTRONIC COMPONENTS EXPOSED TO WEATHER SHALL BE RATED AT NEMA 4X; INCLUDING, BUT NOT LIMITED TO: DISTRIBUTION PANELS, JUNCTION BOXES, RECEPTACLES, OUTLETS, PERIPHERALS, SENSORS, TRANSMITTERS, KEYPADS, AND THE FASTENERS USED/CONNECTIONS MADE THEREFORE.
16. ALL LIGHT POLE AND RVSS TOWER HAND HOLES AND ACCESS PANELS BELOW 20'-0" ABOVE GROUND SHALL EMPLOY PROPRIETARY GEOMETRY, HIGH LEVEL SECURITY, TAMPER-PROOF FASTENERS THAT WILL NOT PROMOTE DISSIMILAR METALS CORROSION.

RVSS TOWER GROUNDING GENERAL NOTES

1. AS PART OF THE WORK, THE CONTRACTOR WILL BE RESPONSIBLE FOR PROVIDING AND INSTALLING A EARTH ELECTRODE SYSTEM (EES) AT THE BASE OF EACH OF THE RVSS TOWER LOCATIONS INDICATED ON THE PLANS. EES SHALL BE UTILIZED FOR FUTURE CONNECTION OF TOWER GROUNDING, TOWER LIGHTNING PROTECTION, ELECTRICAL/FIBER EQUIPMENT AND ENCLOSURE GROUNDING, FENCING / BOLLARDS, AND RVSS UPS EQUIPMENT GROUNDING. FINAL CONNECTIONS TO FUTURE OR OWNER PROVIDED EQUIPMENT NOT INDICATED TO BE INSTALLED ON THESE PLANS SHALL BE BY OTHERS.
2. ALL GROUNDING AT RVSS TOWERS SHALL CONFORM TO FAA-STD-019E AS A MINIMUM.
3. GROUNDING ELECTRODE SYSTEM SHALL BE USED FOR LIGHTNING PROTECTION OF THE FUTURE RVSS TOWER, AND AS SUCH, SYSTEM SHALL BE INSTALLED AND LABELED IN ACCORDANCE WITH ALL UL 96A AND NFPA 780 REQUIREMENTS.
4. SITE SURVEY: A SITE SURVEY SHALL BE CONDUCTED BY THE CONTRACTOR FOR BOTH RVSS SITES INDICATED ON THESE PLANS TO DETERMINE THE GEOLOGICAL AND OTHER PHYSICAL CHARACTERISTICS OF THE SURROUNDING EARTH. INFORMATION TO BE COLLECTED SHALL INCLUDE LOCATION OF ROCK FORMATIONS, GRAVEL DEPOSITS, SOIL TYPES ETC. PERFORM A SOIL RESISTIVITY TEST AT PROBE SPACINGS OF 10, 20, 30 AND 40 FEET IN FOUR DIRECTIONS FROM THE PROPOSED RVSS TOWER AND EQUIPMENT. ALL SURVEY DATA, INCLUDING SOIL RESISTIVITY MEASUREMENTS, SHALL BE NOTED ON A SCALED DRAWING OR SKETCH OF THE SITE AND SUBMITTED TO THE ENGINEER FOR REVIEW.
5. SHOP DRAWINGS: CONTRACTOR SHALL PROVIDE SHOP DRAWINGS OF THE PROPOSED EES TO THE ENGINEER FOR REVIEW AND APPROVAL, INDICATING LOCATIONS OF ALL GROUNDING ELECTRODES, GROUNDING CONDUCTORS, AND OTHER GROUNDING ACCESSORIES AS REQUIRED. THE EES SHALL CONSIST OF AT LEAST (4) DRIVEN GROUND RODS (CONFIGURATION AND DEPTH BASED ON SOIL TEST), SUPPLEMENTAL GROUNDING ELECTRODES (IF REQUIRED), AND BURIED INTERCONNECTING CONDUCTORS. THE SITE SURVEY INFORMATION SHALL BE USED AS THE BASIS FOR THE DESIGN OF THE EES. THE RESISTANCE TO EARTH OF THE EES SHALL BE NOT OVER 10 OHMS. WHERE CONDITIONS ARE ENCOUNTERED SUCH AS ROCK NEAR THE SURFACE, SHALLOW SOILS, PERMAFROST AND SOILS WITH LOW MOISTURE OR MINERAL CONTENT, A SUPPLEMENTAL GROUNDING ELECTRODE MAY BE REQUIRED TO BE USED.
6. SUPPLEMENTAL GROUNDING ELECTRODES: GROUND DISSIPATION PLATES MAY BE USED. IN SHALLOW SOIL LOCATIONS WITH LIMITED SURFACE SPACE, GROUND DISSIPATION PLATES SHALL BE ALLOWED IN PLACE OF GROUND RODS IN THE EARTH ELECTRODE SYSTEM (EES). THE PLATES SHALL BE INSTALLED AT THE CORNERS OF THE EES AT THE FARTHEST ACCESSIBLE POINT FROM THE RVSS TOWER. PLATES SHALL BE CONSTRUCTED OF A MINIMUM ONE QUARTER-INCH THICK COPPER AND BE A MINIMUM OF TWO FEET SQUARE. THESE PLATES SHOULD BE INSTALLED IN A VERTICAL PLANE TO TAKE ADVANTAGE OF SEASONAL MOISTURE AND TEMPERATURE CHANGES IN THE SOIL. INSTALL THE PLATES AT THE SAME DEPTH OR DEEPER THAN THE INTERCONNECTING CONDUCTOR, BUT MAINTAIN A MINIMUM OF ONE-FOOT OF NATIVE SOIL ABOVE THE UPPER EDGE OF THE PLATE. ATTACHMENT TO THE EES SHALL BE WITH A 4/0 AWG BARE STRANDED COPPER CONDUCTOR, EXOTHERMICALLY WELDED TO THE EES AND THE PLATE. THE ATTACHMENT POINT AT THE PLATE SHALL BE AT THE CENTER OF THE PLATE, NOT NEAR THE EDGE OR THE CORNERS. THEY SHALL BE CONFIGURED AS A JORDAN DISSIPATION PLATE DESIGN OR EQUAL.
7. INTERCONNECTIONS: GROUND RODS AND GROUNDING ELECTRODES OF THE EES SHALL BE INTERCONNECTED BY A BURIED, BARE, 4/0 AWG COPPER CONDUCTOR. THE CONDUCTOR SHALL BE BURIED AT 30" BELOW GRADE LEVEL. CONNECTIONS TO THE GROUNDING ELECTRODES SHALL BE EXOTHERMICALLY WELDED. THE INTERCONNECTING CONDUCTOR SHALL CLOSE ON ITSELF FORMING A COMPLETE LOOP WITH THE ENDS EXOTHERMICALLY WELDED. THE BONDING RESISTANCE OF ALL INTERCONNECTIONS SHALL BE ONE MILLIOHM OR LESS FOR EACH BOND WHEN MEASURED WITH A 4-TERMINAL MILLIOHM METER.
8. A MINIMUM OF ONE ACCESS WELL SHALL BE INSTALLED FOR THE EES. THE WELL SHOULD BE LOCATED AT A GROUND ROD THAT IS IN AN AREA WITH ACCESS TO THE OPEN SOIL, SO THAT CHECKS OF THE EES CAN BE MADE ONCE THE FACILITY IS IN USE. THE ACCESS WELL SHALL BE MADE FROM CLAY PIPE, POURED CONCRETE, OR OTHER APPROVED WALL MATERIAL AND SHALL HAVE A REMOVABLE COVER. THE ACCESS WELL SHALL BE CONSTRUCTED TO PROVIDE A MINIMUM CLEARANCE (12 INCHES RADIUS) FROM THE CENTER OF THE GROUND ROD TO THE INSIDE WALL OF THE ACCESS WELL. THE ACCESS WELL SHALL HAVE AN OPENING OF A MINIMUM 12 INCH RADIUS. CONNECTIONS SHALL BE BY EXOTHERMIC WELDS.
9. CONTRACTOR SHALL STAKE OUT THE EXACT LOCATION OF THE BURIED GROUND LOOP CONDUCTOR IN THE FIELD AFTER INSTALLATION, SO THAT IT CAN BE TIED INTO WITH EQUIPMENT AND TOWER GROUND CONDUCTORS BY OTHERS WITH MINIMUM EXCAVATION.
10. GROUND RODS SHALL BE COPPER CLAD STEEL, MINIMUM 10 FEET IN LENGTH AND 3/4" IN DIAMETER. ROD CLADDING SHALL NOT BE LESS THAN 1/100" THICK. GROUND RODS SHALL BE AS WIDELY SPACED AS POSSIBLE, AND IN NO CASE SPACED LESS THAN ONE ROD LENGTH. TOPS OF GROUND RODS SHALL BE NOT LESS THAN 6 INCHES BELOW GRADE LEVEL.
11. GROUND LOOP CONDUCTOR TRENCH SHALL BE EXCAVATED TO 36" BELOW GRADE. CONDUCTOR SHALL BE INSTALLED AT 30" BELOW GRADE. BOTTOM 12" OF TRENCH SHALL BE BACKFILLED WITH BENTONITE/EARTH MIX BACKFILL. REMAINDER OF TRENCH SHALL BE BACKFILLED WITH COMPACTED BACKFILL.
12. CONTRACTOR SHALL PROVIDE AND INSTALL A 24" X 2" X 1/4" COPPER GROUND BAR ON THE INTERIOR WALL OF THE RVSS TOWER EQUIPMENT SHELTER, WITH ISOLATORS AND PRE-DRILLED GROUNDING HOLES. CONNECT GROUND BAR WITH 4/0 AWG GROUND CONDUCTOR TO GROUND LOOP. GROUND BAR SHALL BE USED FOR PANEL/TRANSFORMER/EQUIPMENT GROUNDING CONNECTIONS PER CODE REQUIREMENTS WITHIN EQUIPMENT SHELTER.
13. THE GROUNDING SYSTEM SHALL BE CONSTRUCTED IN ACCORDANCE WITH UL 96 AND NFPA 780 REQUIREMENTS. CERTIFICATION SHALL BE PERFORMED BY AN INDEPENDENT, THIRD-PARTY INSPECTION FIRM. THE INSPECTION FIRM CANNOT BE THE SYSTEM DESIGNER OR INSTALLER.

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MARK	DESCRIPTION	DATE

ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

DESIGNED BY: M.J. HILL
DRAWN BY: D.A. NELSON
CHECKED BY:
SUBMITTED BY:
SIZE: ANSI D

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ETEGRA
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DALLAS, TX, 75252

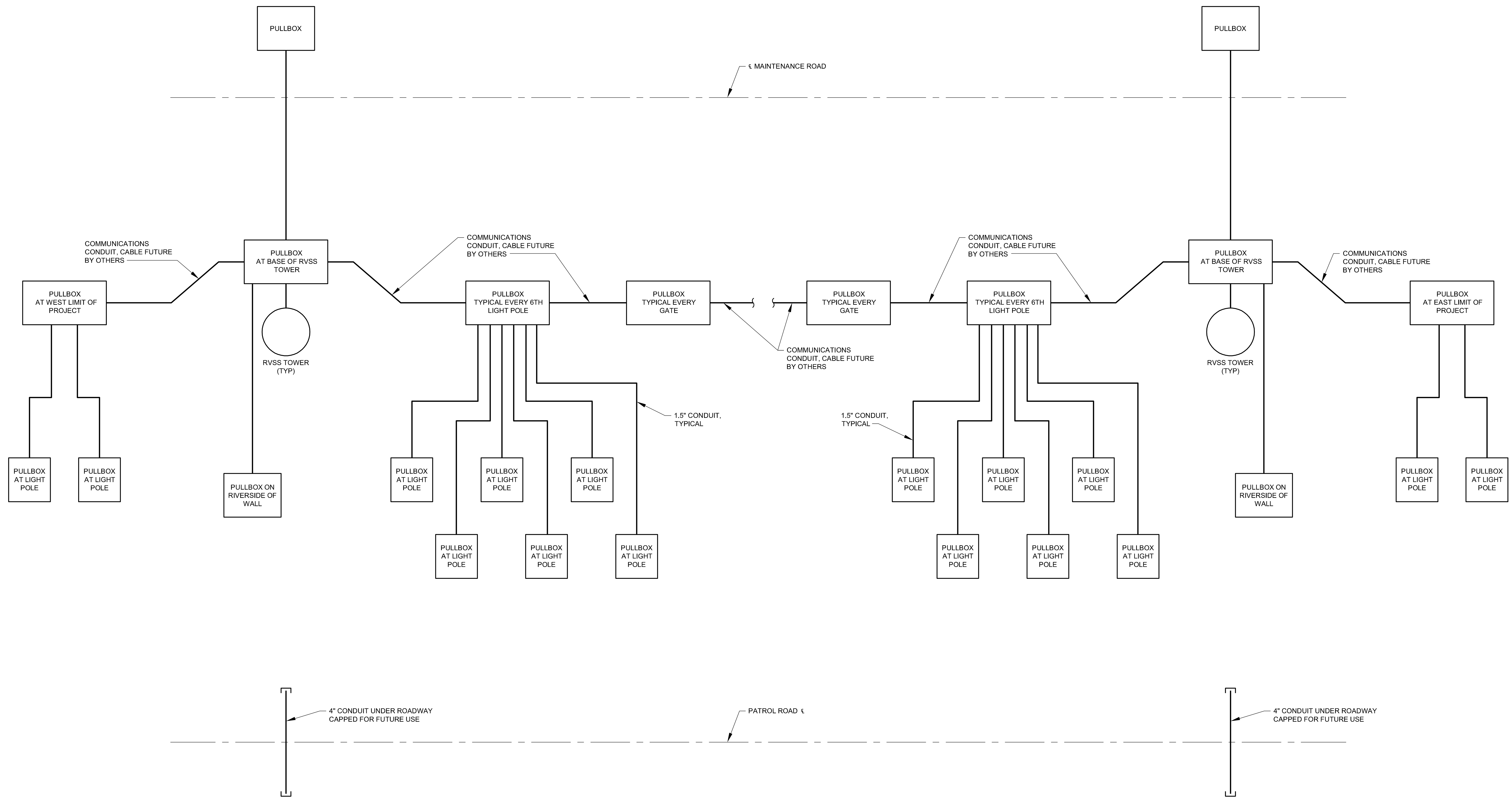
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BARRIER FENCE

ELECTRICAL AND COMMUNICATION NOTES

SHEET ID
RGC
E-002

NOTES:

1. DUCTBANK AND QUANTITY AND SIZE OF CONDUITS BY CONTRACTOR TO BE COORDINATED WITH OWNER.



CONCEPTUAL OVERALL COMMUNICATIONS CONDUIT INFRASTRUCTURE

NO SCALE

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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE
CONCEPTUAL OVERALL CAMERA CONDUIT INFRASTRUCTURE

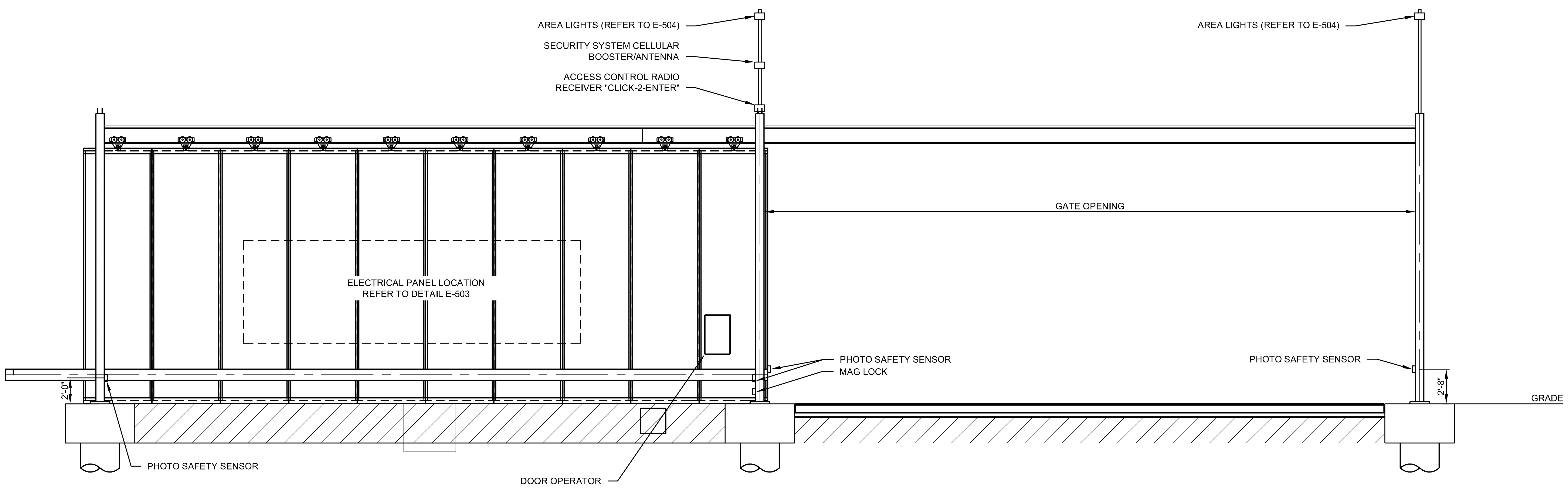
SHEET ID
RGC
E-101

GENERAL NOTES

1. RATING OF THE MANUAL TRANSFER SWITCH'S TRANSFER PANEL "QUICK COUPLING" SHALL BE COORDINATED WITH THE SIZE OF THE ANTICIPATED MOBILE EMERGENCY GENERATOR.
2. KEYPADS MAY NEED TO BE RE-LOCATED TO REFLECT ACTUAL SITE CONDITIONS.
3. MAGLOCK SHALL BE PLACED UNDER GATE OPERATOR.
4. UNLESS NOTED OTHERWISE, RUN UNDERGROUND CONDUITS LOCATED ALONG AND IN THE VICINITY OF THE GATE OPENING UNDER THE 4' WIDE x 8" DEEP GATE OPENING CONCRETE SLAB.

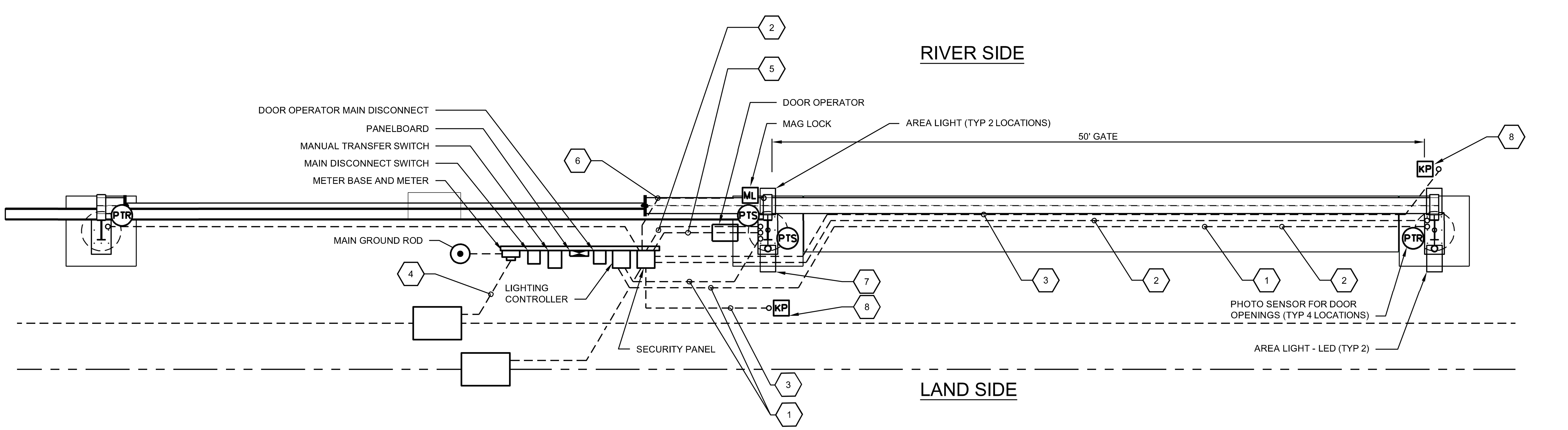
XX KEYED NOTES

1. POWER FOR AREA LIGHTS - 1" SCHEDULE 80 - TO LIGHTING CONTACTOR.
2. CONDUIT FOR PHOTO SAFETY SENSOR - 1" SCHEDULE 80 - TO SECURITY.
3. CONDUIT FOR SECURITY KEYPAD - 1" SCHEDULE 80.
4. CONDUIT FOR CONNECTION TO RGV-06 POWER DUCTBANK SCHEDULE 80.
5. CONDUIT FOR "CLICK-TO-ENTER" AND CELLULAR ANTENNA SYSTEM - 1" SCHEDULE 80.
6. CONDUIT FOR MAGNETIC LOCK - 1" SCHEDULE 80.
7. FIXTURE IDENTIFIED SHALL BE CONNECTED TO BATTERY CIRCUIT. SEE DETAIL E-605.
8. PROVIDE GOOSENECK MOUNTING ARM AND CONCRETE BASE FOR MOUNTING OF KEYPAD. SEE CIVIL PLANS FOR EXACT LOCATION OF KEYPADS.



GATE PHOTOELECTRIC BEAM DEVICES MOUNTING HEIGHTS

SCALE: 3/16" = 1'-0"



GATE ELECTRICAL LAYOUT - RIGHT SIDE LAYOUT

SCALE: 3/16" = 1'-0"

AT FULL SIZE
0 1 2 3 IN
0 1 2 3 4 5 6 7 8 cm

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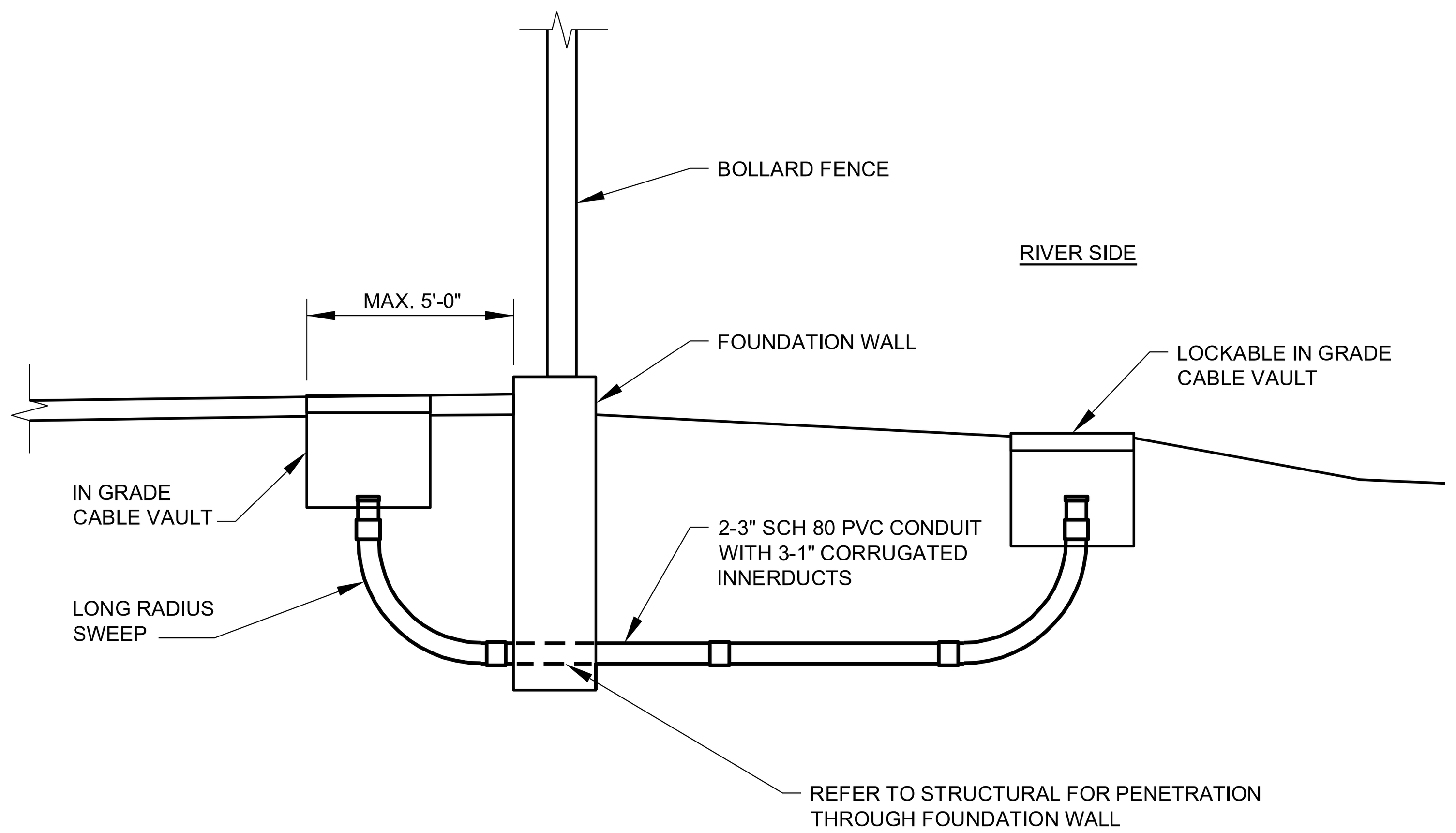
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE
ELECTRICAL SINGLE GATE - PLAN VIEW
50 FEET SINGLE LEAF AUTOMATED GATE

SHEET ID
RGC
E-102



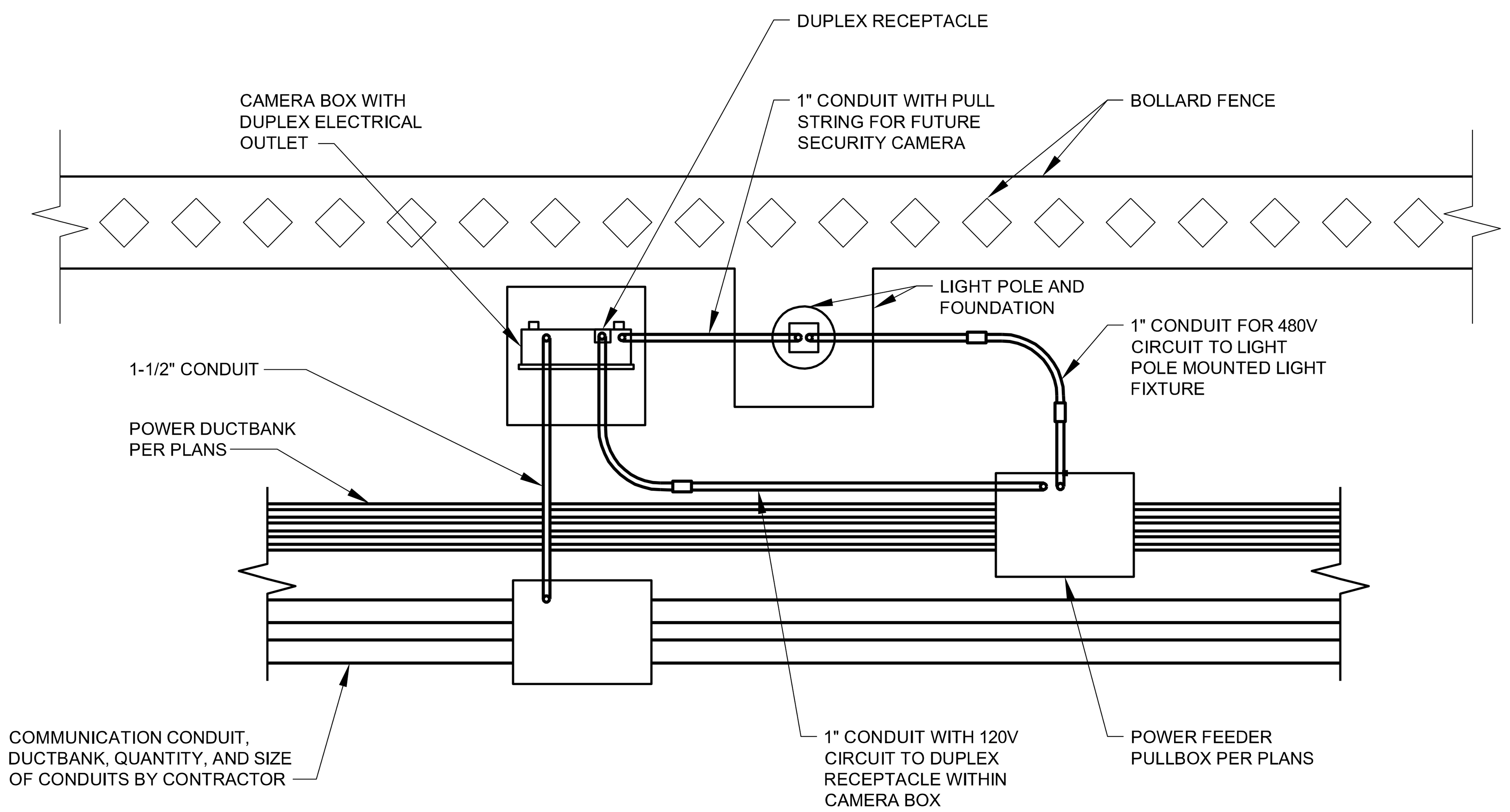
SECTION

NOTES:

1. IN ADDITION TO PENETRATIONS FOR RVSS TOWERS PROVIDE AT BEGINNING AND END OF EACH CONTRACT WALL SEGMENT FOR FUTURE CONNECTIONS.

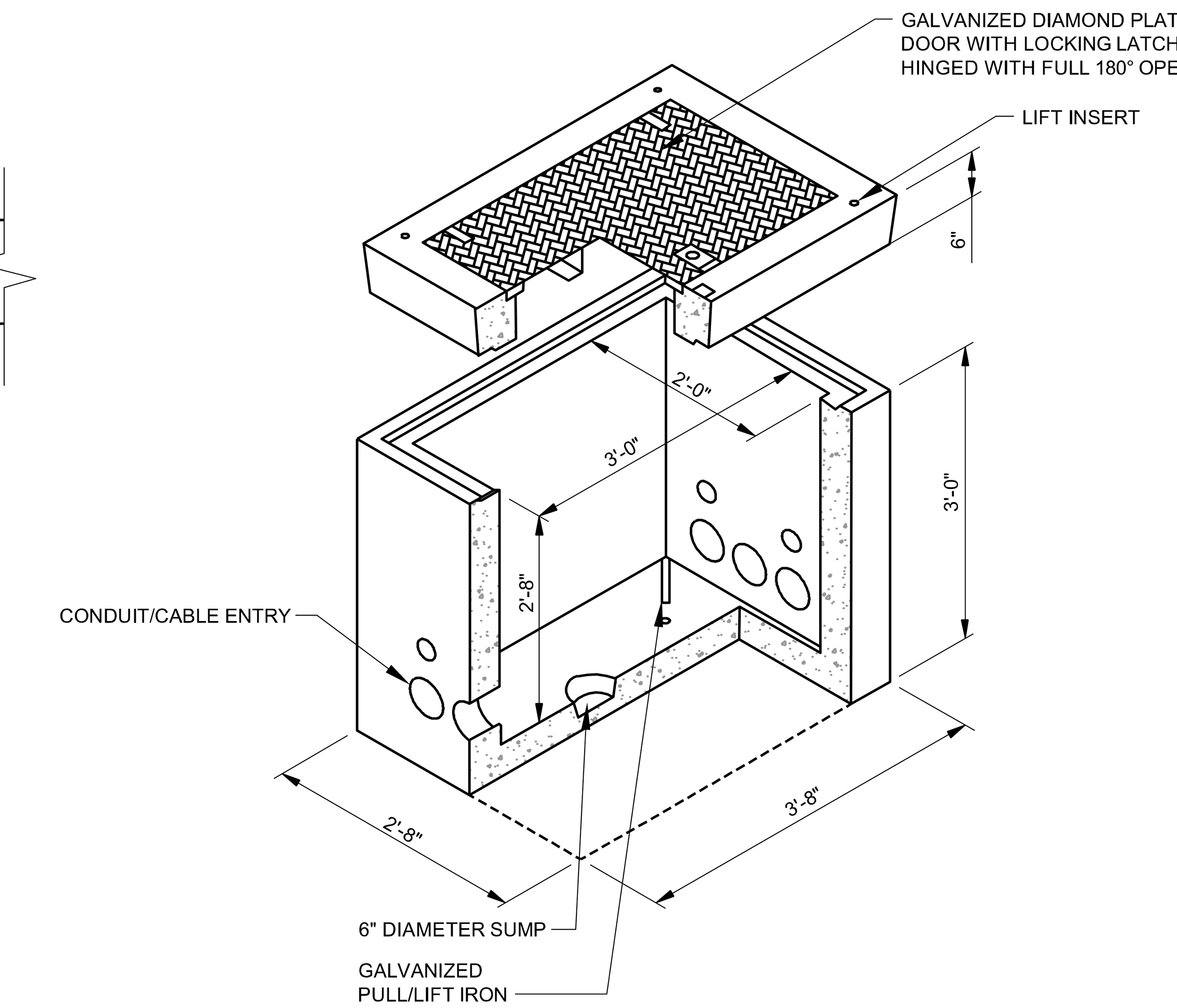
COMMUNICATIONS CONDUIT ROUTING TO RIVERSIDE

NO SCALE



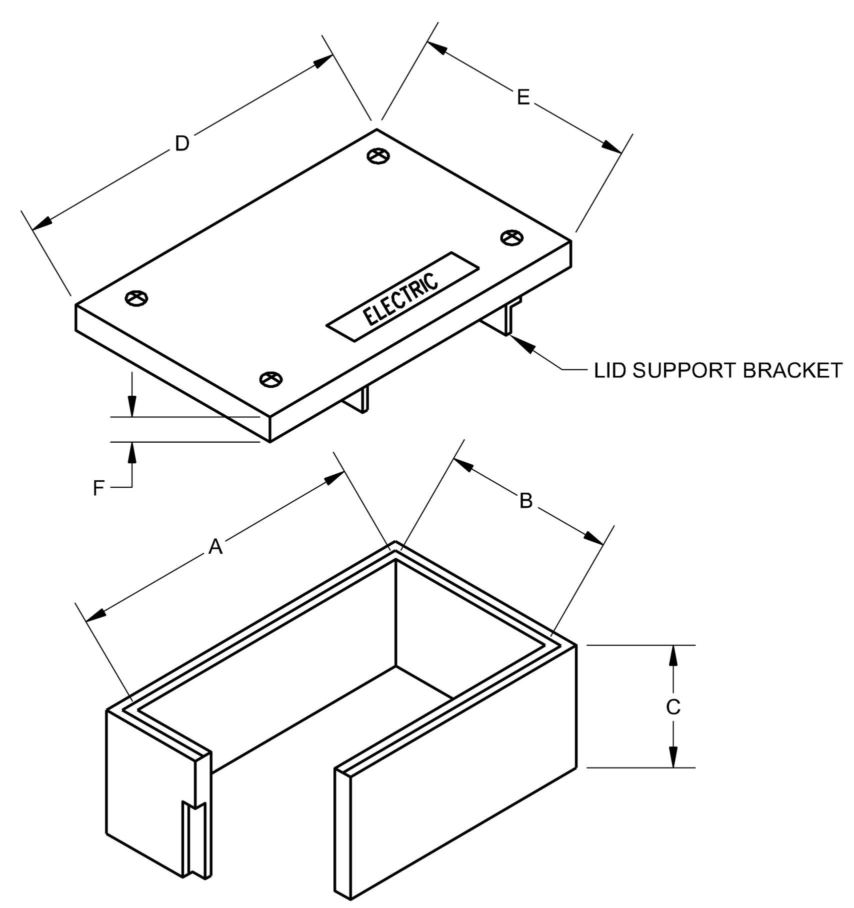
TYPICAL PLAN VIEW AT LIGHT POLES

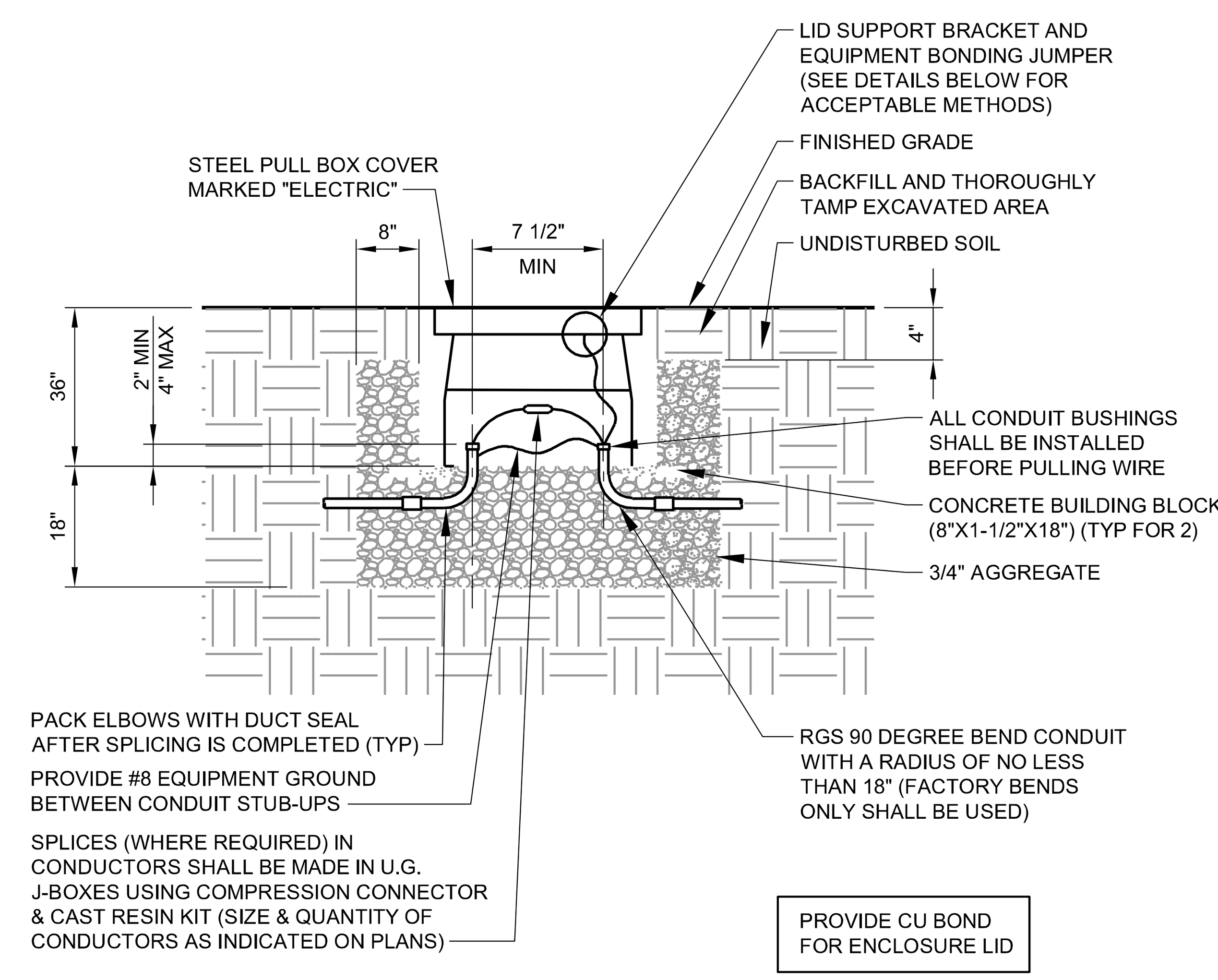
NO SCALE



UNDERGROUND COMMUNICATION CABLE VAULT DETAIL (RIVER SIDE)

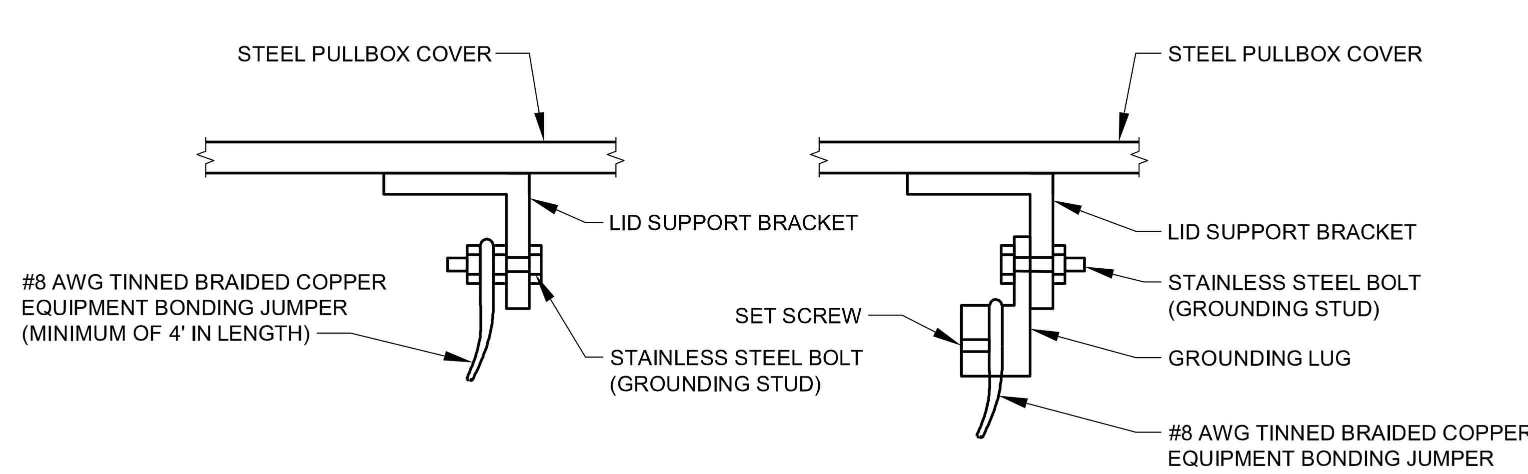
NO SCALE





NOTES:

1. INSTALL A 1/4"-20 NC X 3/4" STAINLESS STEEL GROUNDING STUD TO THE LID SUPPORT MEMBER(S) ON THE BOTTOM OF LID BY DRILLING A HOLE THROUGH THE "L", "C", OR "T"-SHAPED SUPPORT MEMBER. SECURE GROUNDING STUD AND BONDING JUMPER WITH TWO (2) STAINLESS STEEL NUTS AND FLAT WASHERS.
2. SECURE GROUNDING LUG TO THE LID SUPPORT MEMBERS TO THE BOTTOM OF LID BY DRILLING A HOLE THROUGH THE "L", "C", OR "T"-SHAPED SUPPORT MEMBER AND INSTALLING A 1/4"-20 NC X 3/4" STAINLESS STEEL GROUND STUD. INSERT BONDING JUMPER INTO GROUNDING LUG AND SECURE WITH SET SCREW.



TYPICAL HANDHOLE / PULL BOX DETAIL (COMM AND POWER, SECURE SIDE)

NO SCALE

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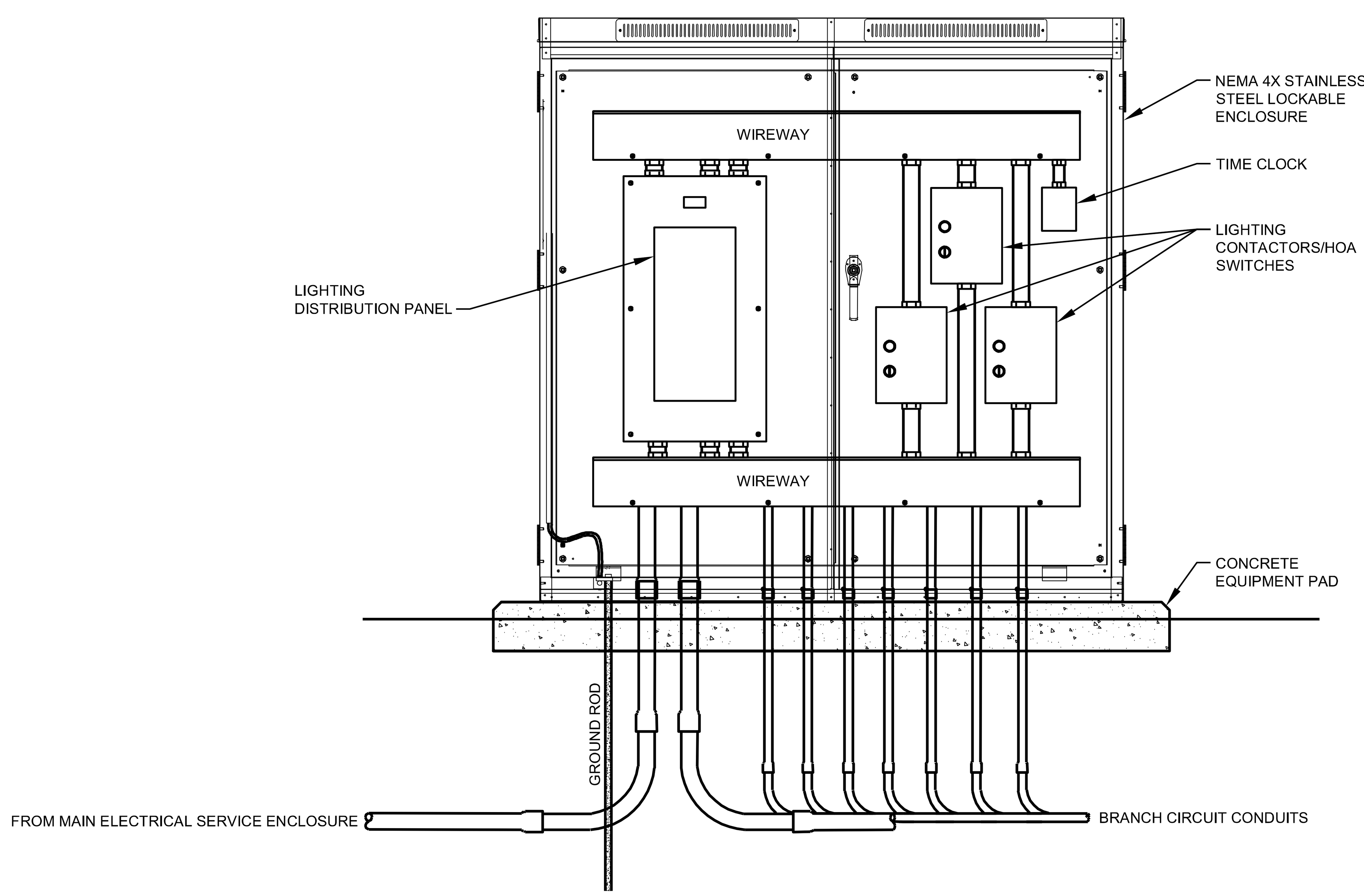
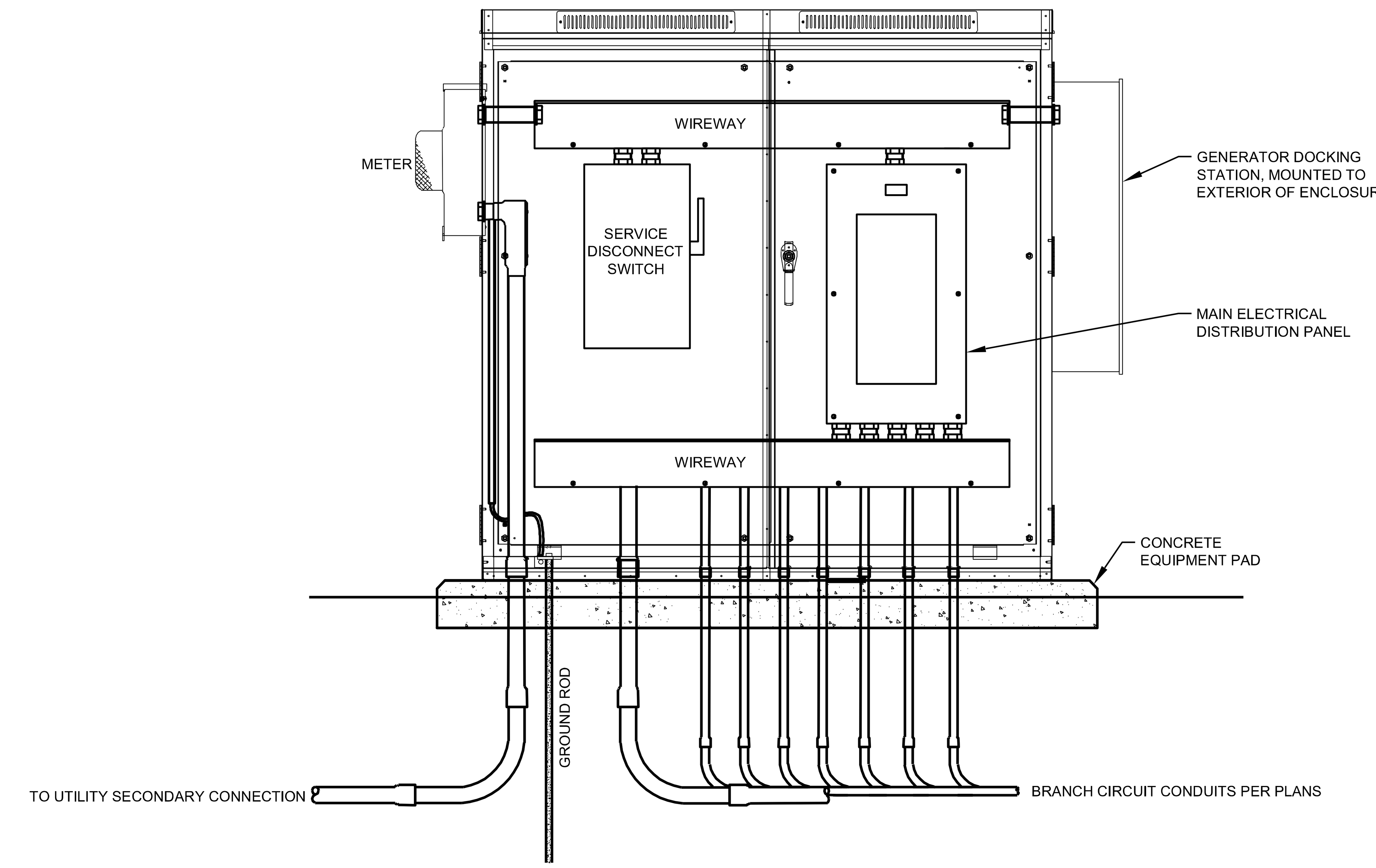
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE
CONDUIT ROUTING DETAILS

SHEET ID
RGC
E-501



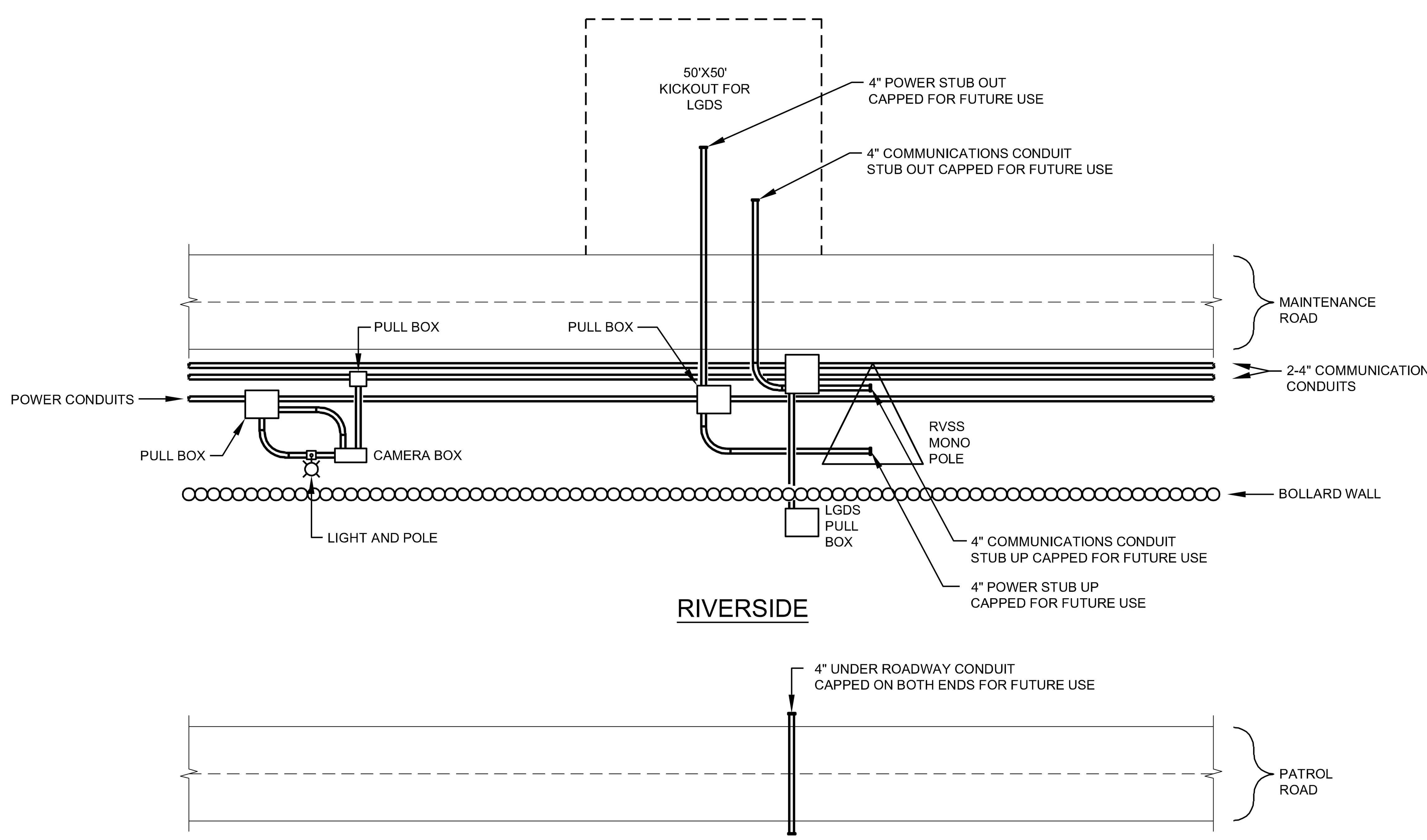
TYPICAL LIGHTING DISTRIBUTION ENCLOSURE

NOT TO SCALE



TYPICAL UTILITY CONNECTION POINT ELECTRICAL SERVICE ENCLOSURE

NOT TO SCALE



RVSS TOWER TYPICAL PLAN VIEW

NOT TO SCALE

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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE
RVSS TOWER YARD EQUIPMENT DETAILS

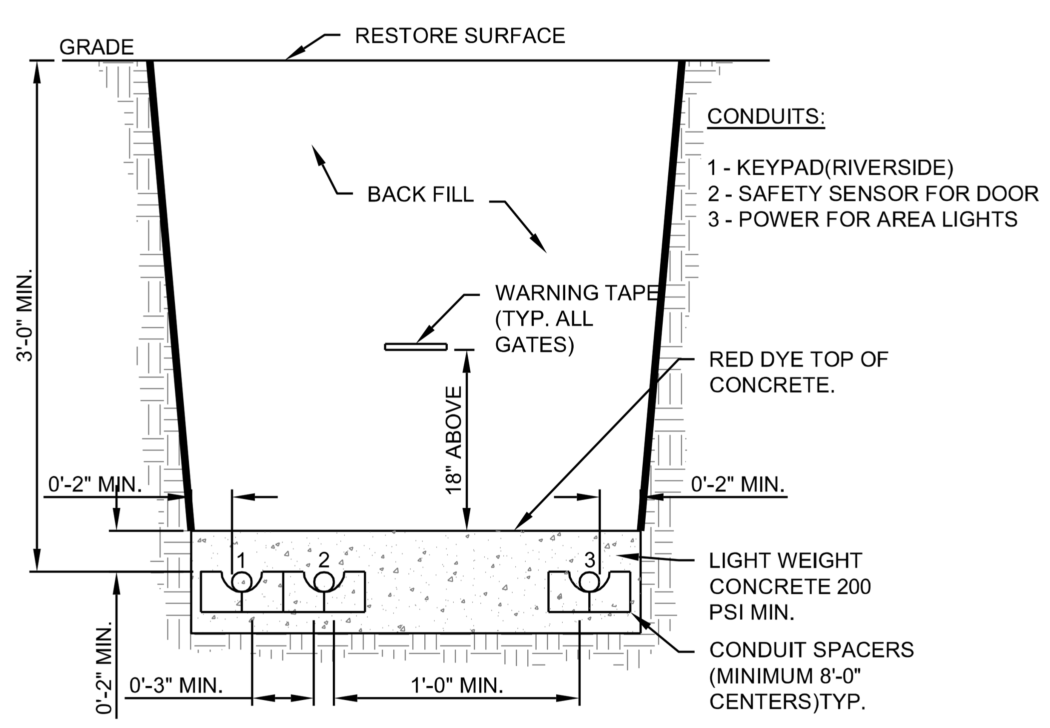
SHEET ID
RGC
E-502

GENERAL NOTES

1. PROVIDE SUPPORT POSTS AND UNISTRUT MOUNTING RAILS AS REQUIRED. ALL STRUCTURE, CLAMPS AND ACCESSORIES SHALL BE CORROSION RESISTANT.
2. ALL BELOW GRADE CONDUIT SHALL BE SCHEDULE 80 PVC.
3. ALL ABOVE GRADE CONDUIT SHALL BE RIGID GALVANIZED STEEL CONDUIT.
4. ALL HARDWARE SHALL BE STAINLESS STEEL, WHERE POSSIBLE.
5. UNDERGROUND CONDUITS SHALL BE CONTINUOUSLY MARKED WITH FOIL-BACKED ELECTRICAL WARNING TAPE "CAUTION - ELECTRICAL LINE BURIED BELOW" WARNING TAPE SHALL BE INSERTED 18" ABOVE THE CENTER OF THE TOP OF THE CONDUITS.
6. WHERE ELECTRICAL EQUIPMENT IS EXPOSED TO THE ENVIRONMENT PROVIDE NEMA 4X ENCLOSURES. PROVIDE WEATHERPROOF ENCLOSURES FOR RECEPTACLES.

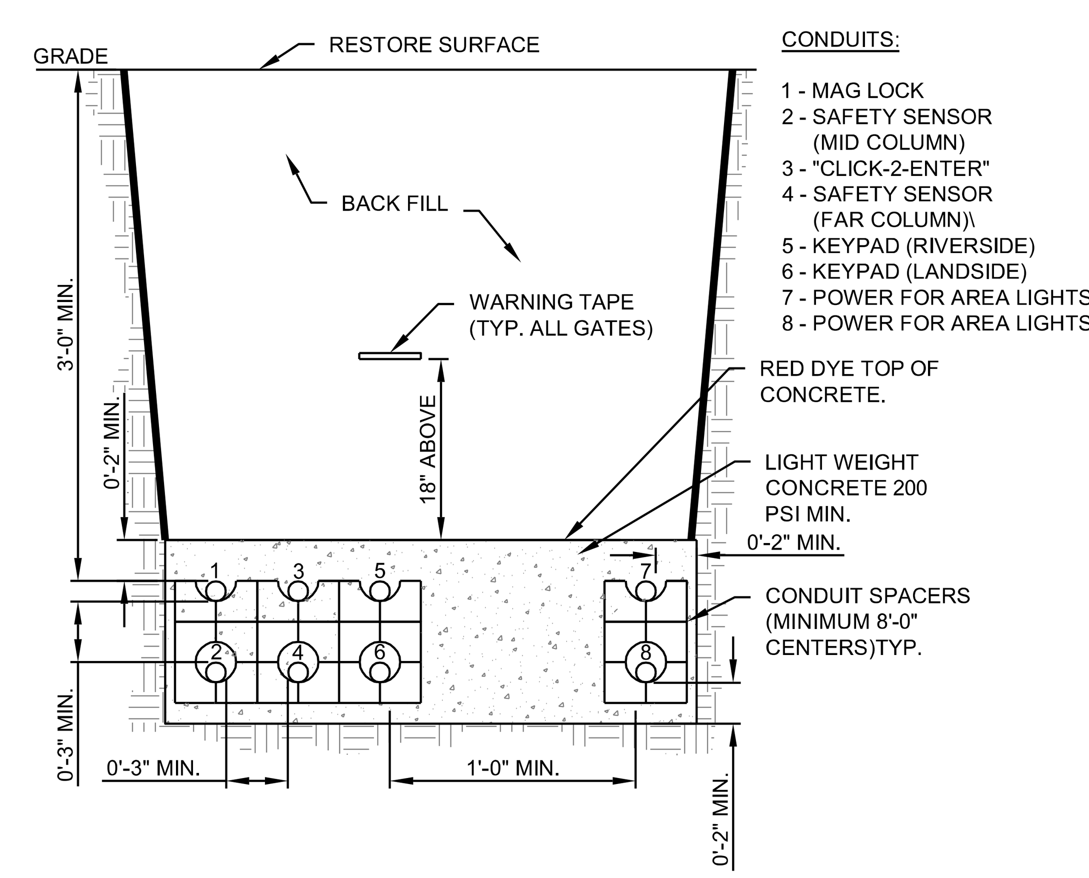
XX KEYED NOTES

1. THE FLANGED INLET LOCKING PLUG SHALL BE INSTALLED WITH A GASKET BETWEEN THE PLUG AND THE ENCLOSURE



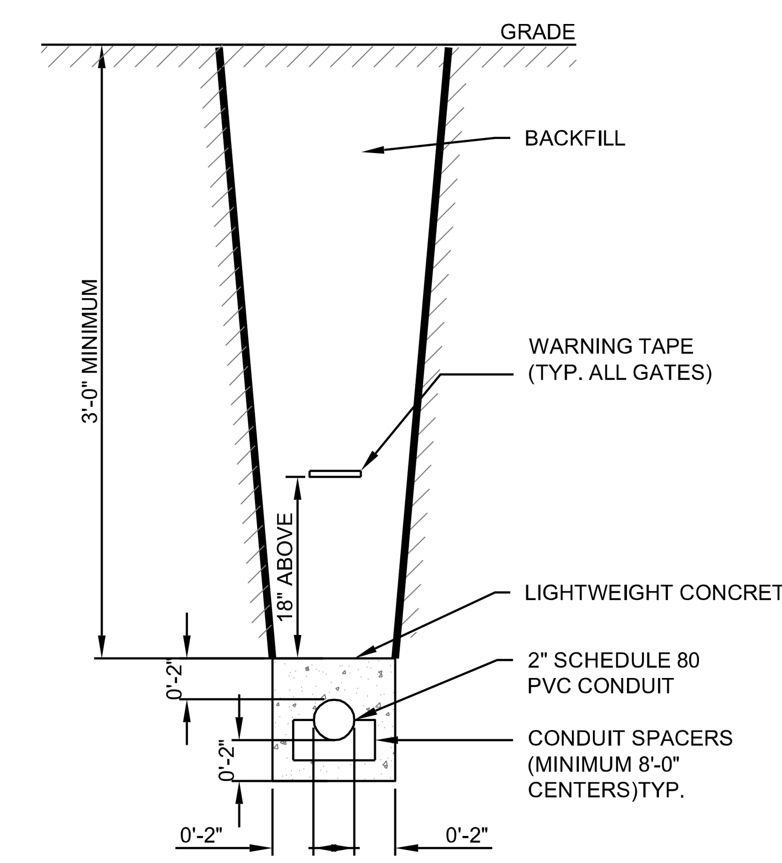
GATE POWER, SECURITY, AND CONTROLS DUCT BANK SECTION

NO SCALE



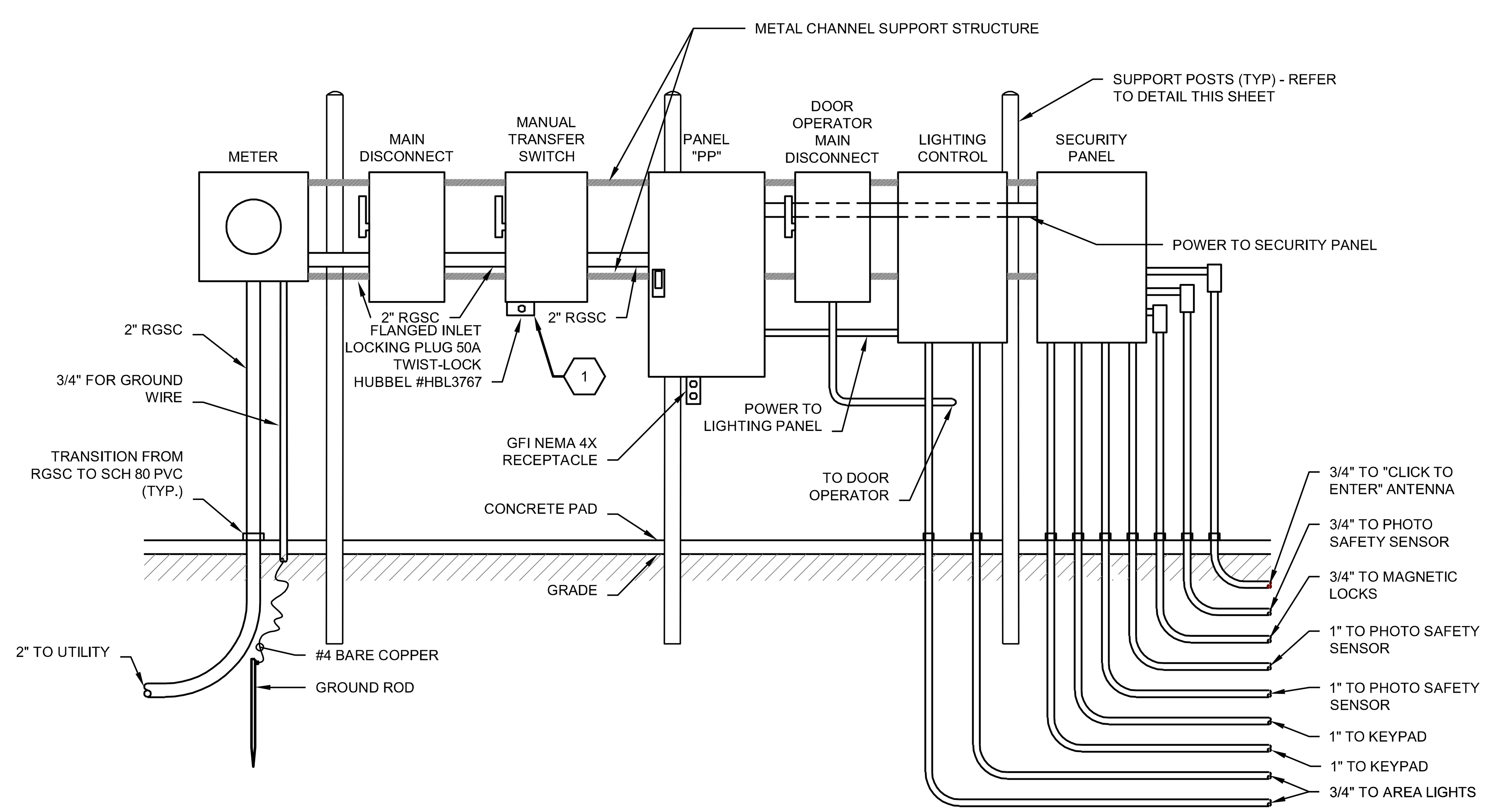
GATE POWER, SECURITY, AND CONTROLS DUCT BANK SECTION

NO SCALE



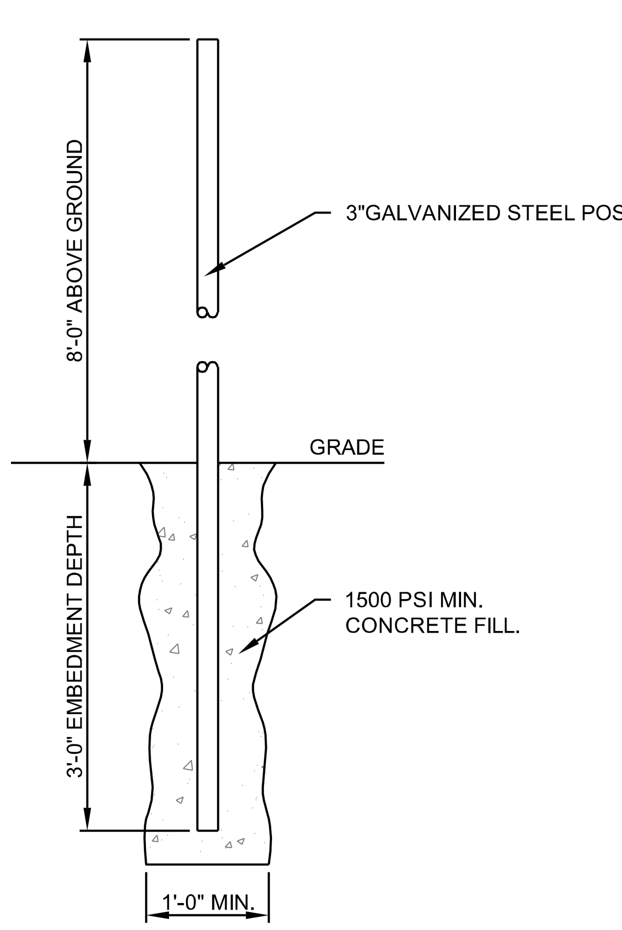
ELECTRICAL SERVICE DUCT BANK

NO SCALE



GATE POWER, SECURITY, AND CONTROLS PANEL ELEVATION DETAIL

NO SCALE



MOUNTING POLE DETAIL

NO SCALE

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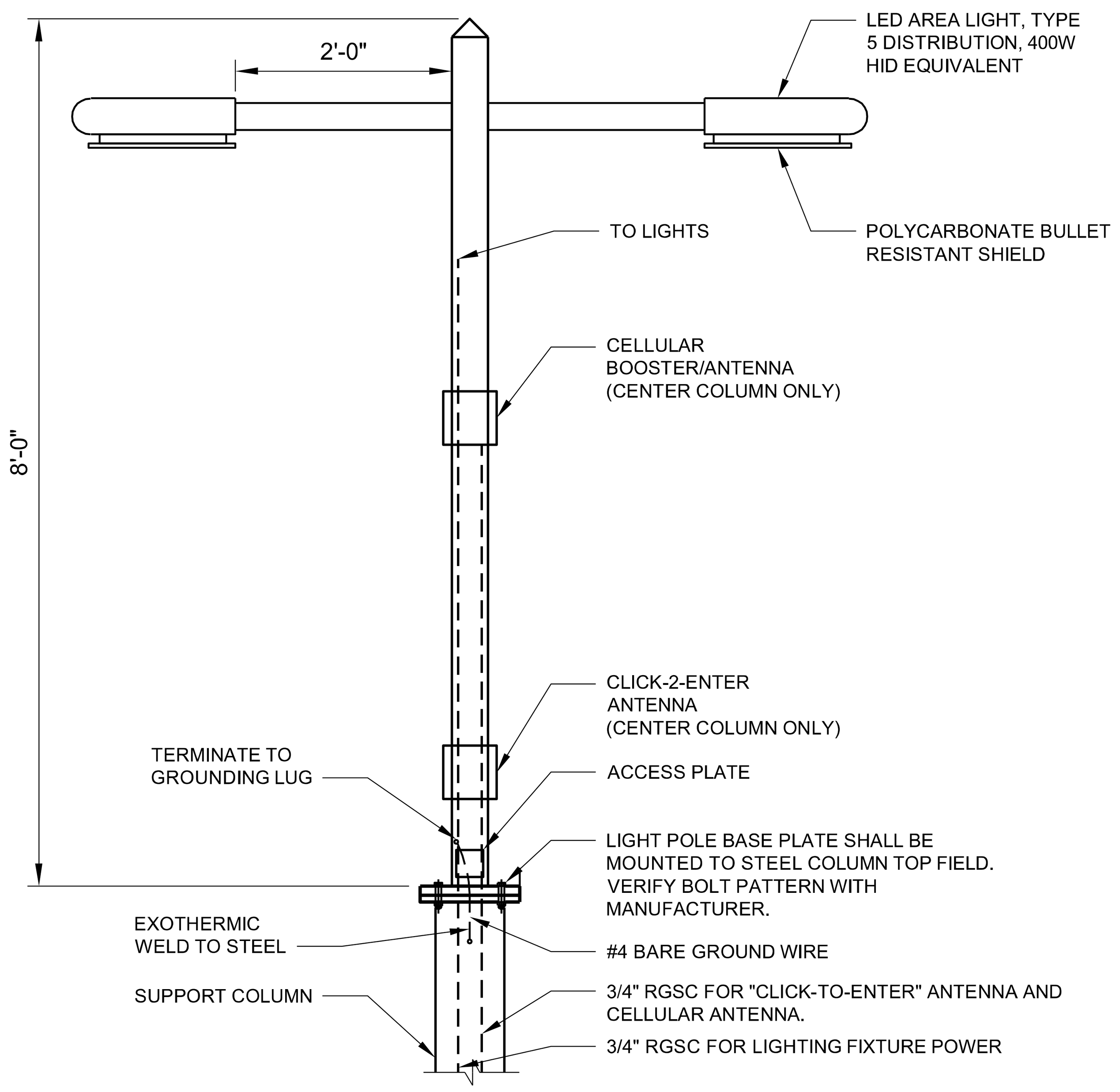
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE

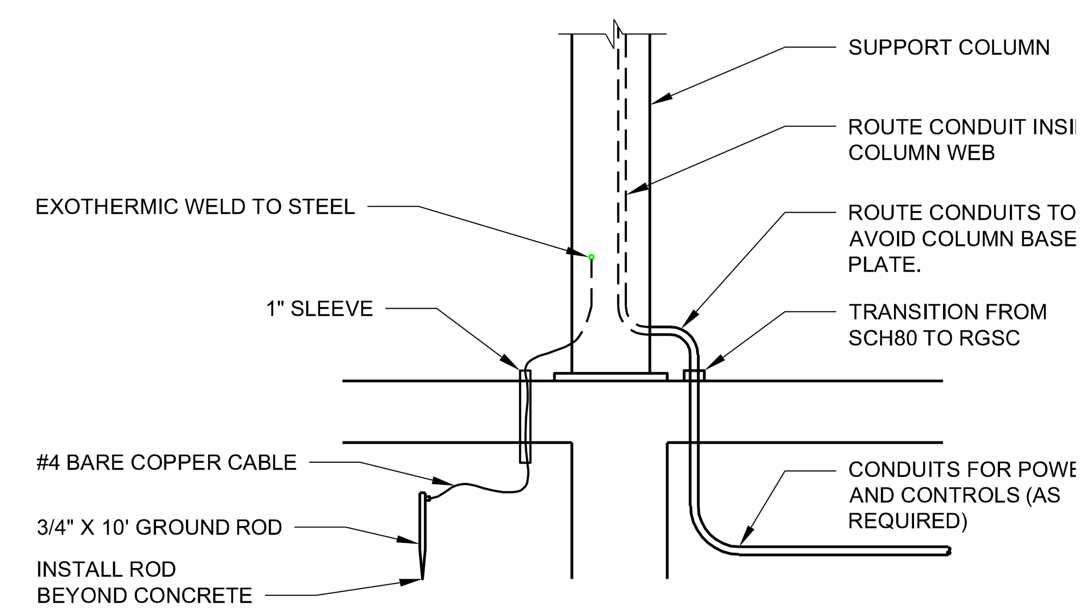
ELECTRICAL DETAILS - SHEET 1
50 FEET SINGLE LEAF AUTOMATED GATE

SHEET ID
RGC
E-503



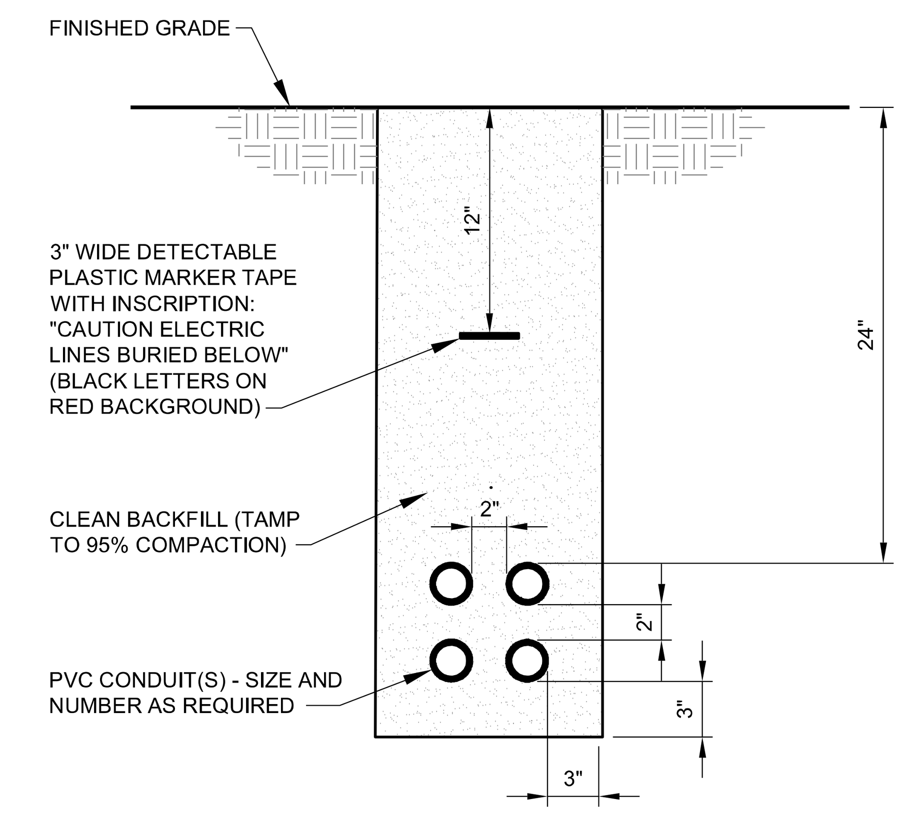
GATE LIGHT POLE DETAIL

NO SCALE



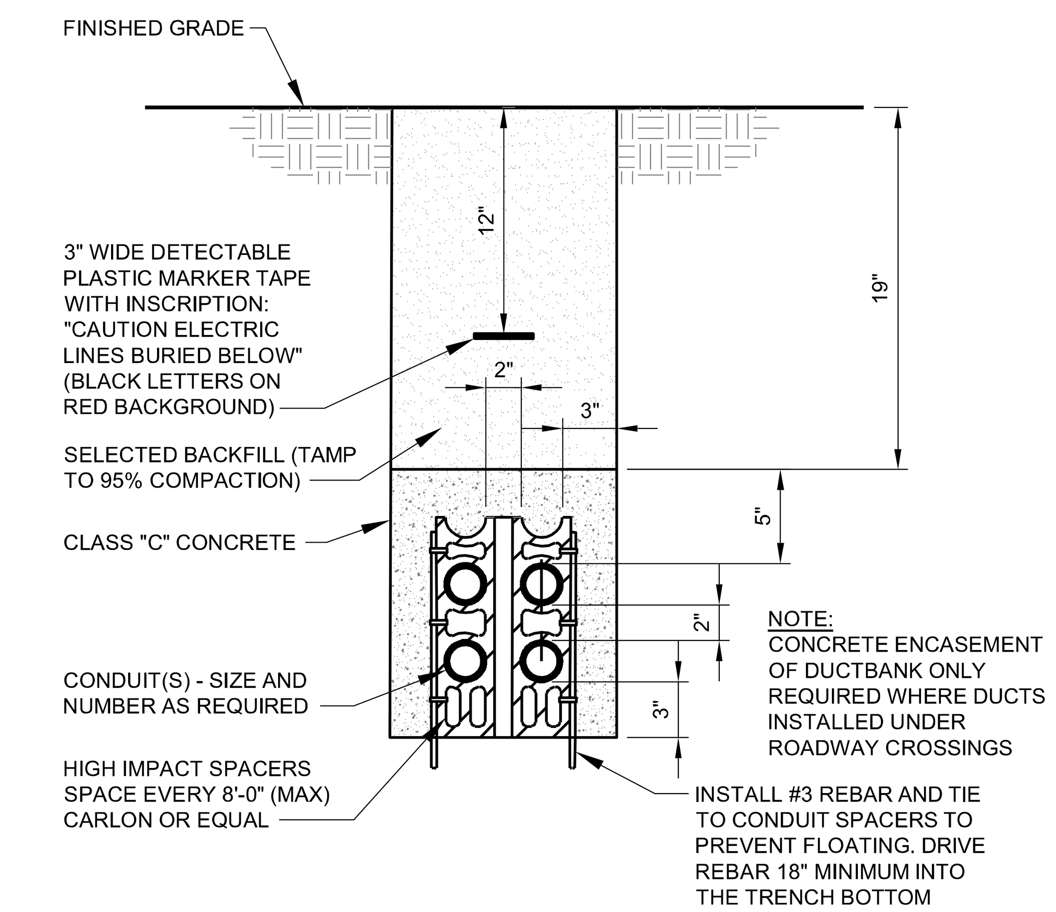
GATE POLE DETAIL AT COLUMN BASE

NO SCALE



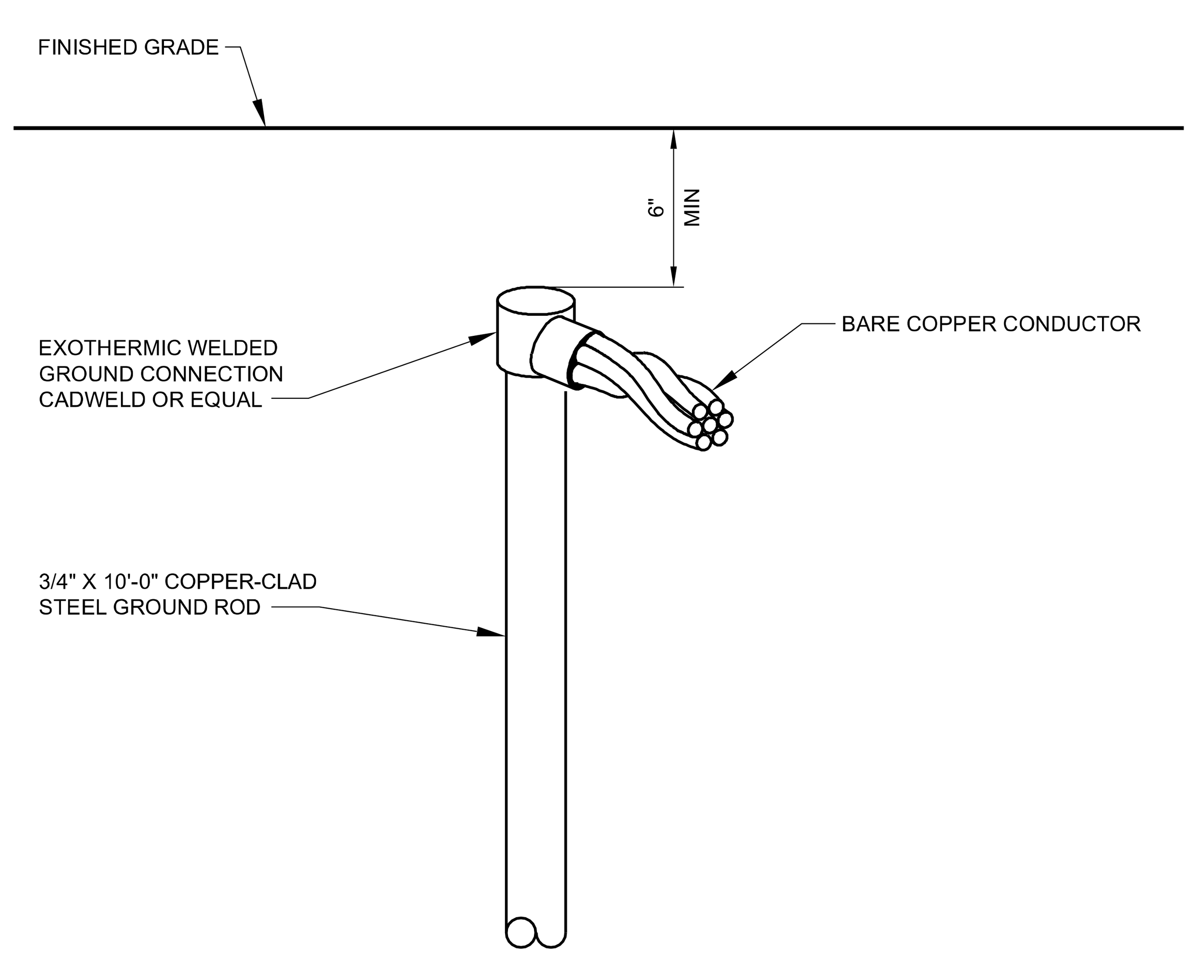
TYPICAL DIRECT BURIED DUCTBANK DETAIL

NO SCALE



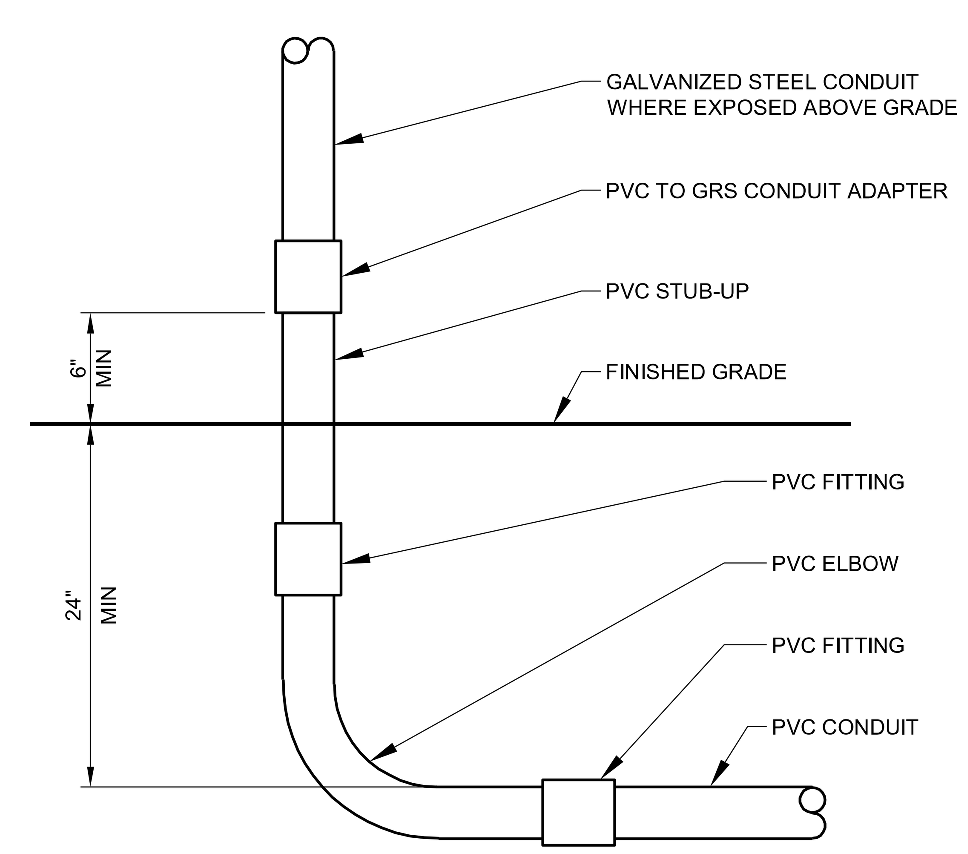
TYPICAL CONCRETE ENCASED DUCTBANK DETAIL

NO SCALE



TYPICAL GROUND ROD DETAIL

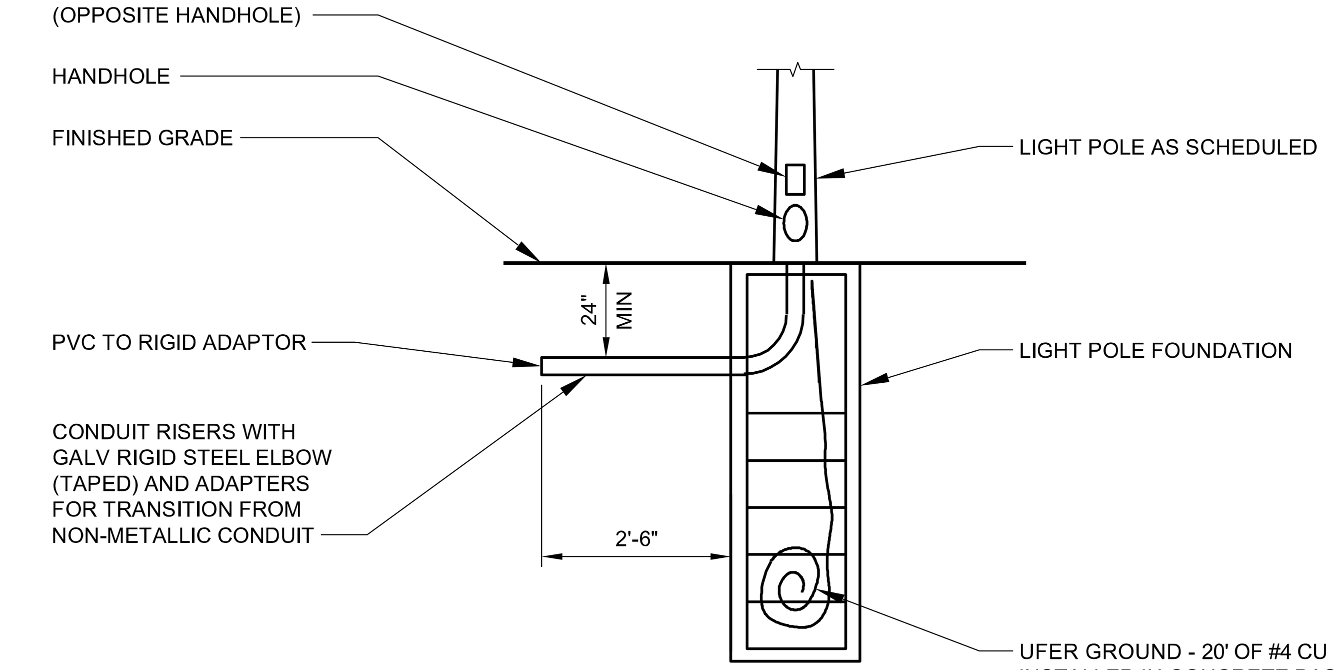
NO SCALE



NOTE:
WHERE CONDUITS ARE RUN IN SLAB, THE 24" DIMENSION DOES NOT APPLY.

TYPICAL CONDUIT STUB-UP DETAIL

NO SCALE



TYPICAL LIGHT POLE GROUNDING DETAIL

NO SCALE

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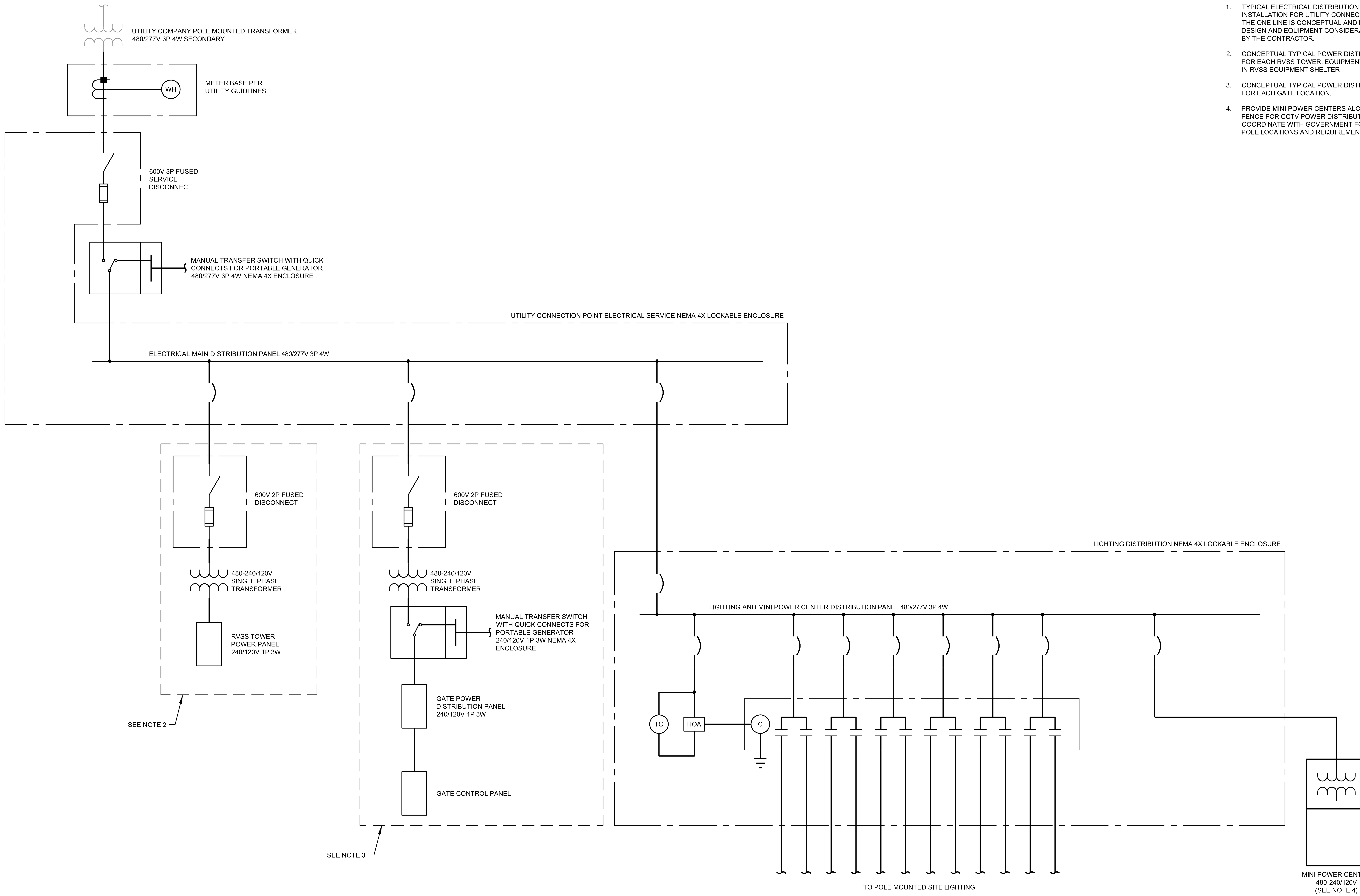
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE
ELECTRICAL DETAILS - SHEET 2
50 FEET SINGLE LEAF AUTOMATED GATE

SHEET ID
RGC
E-504

NOTES:

1. TYPICAL ELECTRICAL DISTRIBUTION EQUIPMENT INSTALLATION FOR UTILITY CONNECTION POINT. THE ONE LINE IS CONCEPTUAL AND FINAL DESIGN AND EQUIPMENT CONSIDERATIONS ARE BY THE CONTRACTOR.
2. CONCEPTUAL TYPICAL POWER DISTRIBUTION FOR EACH RVSS TOWER. EQUIPMENT LOCATED IN RVSS EQUIPMENT SHELTER
3. CONCEPTUAL TYPICAL POWER DISTRIBUTION FOR EACH GATE LOCATION.
4. PROVIDE MINI POWER CENTERS ALONG THE FENCE FOR CCTV POWER DISTRIBUTION. COORDINATE WITH GOVERNMENT FOR LIGHT POLE LOCATIONS AND REQUIREMENTS.



CONCEPTUAL UTILITY SERVICE POINT ELECTRICAL ONE-LINE DIAGRAM

NO SCALE

US Army Corps of Engineers ®

MARK | DESCRIPTION | DATE

ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:
DESIGNED BY: M.J. HILL
DRAWN BY: D.A. NELSON
CHECKED BY:
SUBMITTED BY:
SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE
CONCEPTUAL ONE-LINE DIAGRAM

SHEET ID
RGC
E-601

Panel: PP

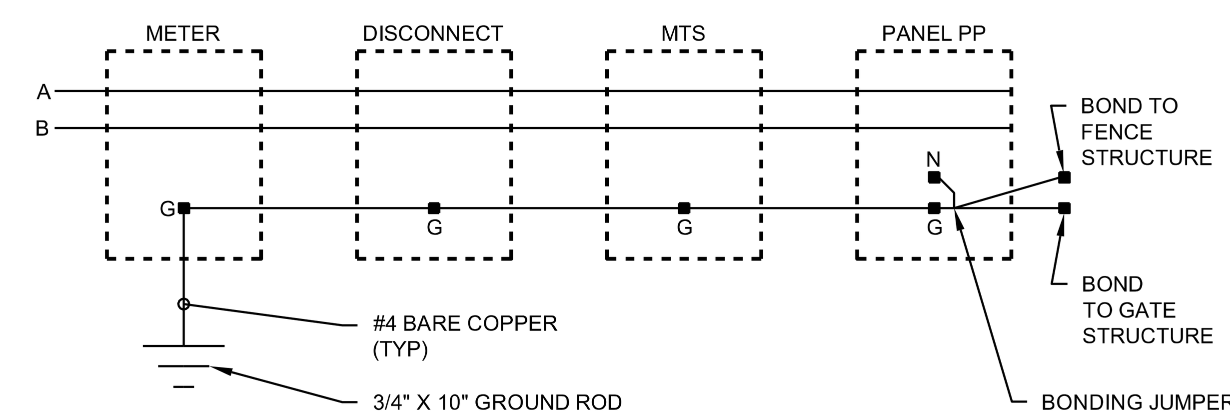
Location:	Volts: 240/120V	A.I.C Rating: 10,000
Supply From: MTS	Phases: 1 P	Mains Type: MCB
Mounting: Surface	Wires: 3 Wire	Mains Rating: 200A
Enclosure: NEMA 4X		MCB Rating: 200A

CKT	Circuit Description	Trip	Poles	A		B		Poles	Trip	Circuit Description	CKT
1	DOOR OPTR (7.5HP)	70A	2P	2460	0			2P	20A	SURGE SUPPRESSOR	2
3	-	-	-			2460	0	-	-	-	4
5	GFCI OUTLETS	20A	1P	180	400			1P	20A	SECURITY PANEL	6
7	LIGHTS	20A	1P			723	1000	1P	20A	SECURITY PANEL	8
9	LIGHTS	20A	1P	241	-			1P	20A	Spare	10
11	Spare	20A	1P			-	-	1P	20A	Spare	12
13	Spare	20A	1P	-	-			1P	20A	Spare	14
15	Spare	20A	1P			-	-	1P	20A	Spare	16
17	Spare	20A	1P					1P	20A	Spare	18
19	Spare	20A	1P			-	-	1P	20A	Spare	20
21	Spare	20A	1P	-	-			1P	20A	Spare	22
23	Spare	20A	1P			-	-	1P	20A	Spare	24
			Total Load:	3281	VA	4183	VA				
			Total Amps:	27.3	Amps	34.9	Amps				

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Power	1303	100%	1303	Total Conn. Load (VA):	7187
Lighting	964	125%	1205	Total Est. Demand (VA):	7428
Motor/HVAC	4920	100%	4920	Total Amps:	31.0

GATE ELECTRICAL PANEL SCHEDULE

NO SCALE



GATE GROUNDING DETAIL

NO SCALE

LUMINAIRE SCHEDULE										
		LIGHT SOURCE DATA				DRIVER/BALLAST		POWER DATA		
TYPE	GENERAL DESCRIPTION	LAMP TYPE	QTY x WATTS/LAMP	LAMP CODE/LED MODULE	LED DELIVERED LUMENS	CONTROL TYPE	DIMMING	SUPPLY VOLT	WATTS PER FIXT.	NOTES
	POLE MOUNTED LIGHT FIXTURE, 27FT POLE. REFERENCE SPECIFICATIONS FOR REQUIREMENTS FOR POLE, FIXTURE, AND ACCESSORIES	LED	BY CONTRACTOR	FURNISHED WITH FIXTURE	BY CONTRACTOR	NA	0-10V	480V	1200W MAX	

SITE LUMINAIRE SCHEDULE

NO SCALE

GENERAL NOTES

1. ALL ELECTRICAL EQUIPMENT SHALL BE RATED NEMA 4X
2. ALL ELECTRICAL EQUIPMENT SHALL BE RATED FOR 10KAIC MINIMUM.
3. ALL CONDUCTORS SHALL BE #12 AWG UNLESS NOTED OTHERWISE

CALCULATIONS

ASSUMPTIONS:

TRANSFORMER SIZE: 25kVA
IMPEDANCE: 1.58 Z (ESTIMATED)
UPSTREAM BUS CAPACITY: INFINATE
DISTANCE FROM TRANSFORMER: 50FT

SHORT CIRCUIT CURRENT:

IFL = (XFMR SIZE x 1000) / (VOLTAGE(LINE-LINE))

IFL = (25 x 1000) / (240) = 104.16A

IsC = IFL / %Z

IsC = (104.16A) / (.0158) = 6592 AMPS MAX

M = 1 / (1+F)

F = (2x(DISTANCE) x IsC) / ((CONSTANT) x (VOLTAGE))

F = (2 x 50FT x 6592A) / (13923 x 240) = 0.1972

M = 1 / (1 + 0.1972) = .8352

IsC(actual) = (6592 x 0.8352) = 5506A

PANEL BOARD MINIMUM
AIC = 10K AIC

ABBREVIATIONS

M = MULTIPLIER
F = FACTOR
IsC = SHORT CIRCUIT CURRENT

US Army Corps of Engineers ®

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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BARRIER FENCE

ELECTRICAL SCHEDULES & DIAGRAMS
50 FEET SINGLE LEAF AUTOMATED GATE

SHEET ID
RGC
E-602

SHEET NOTES

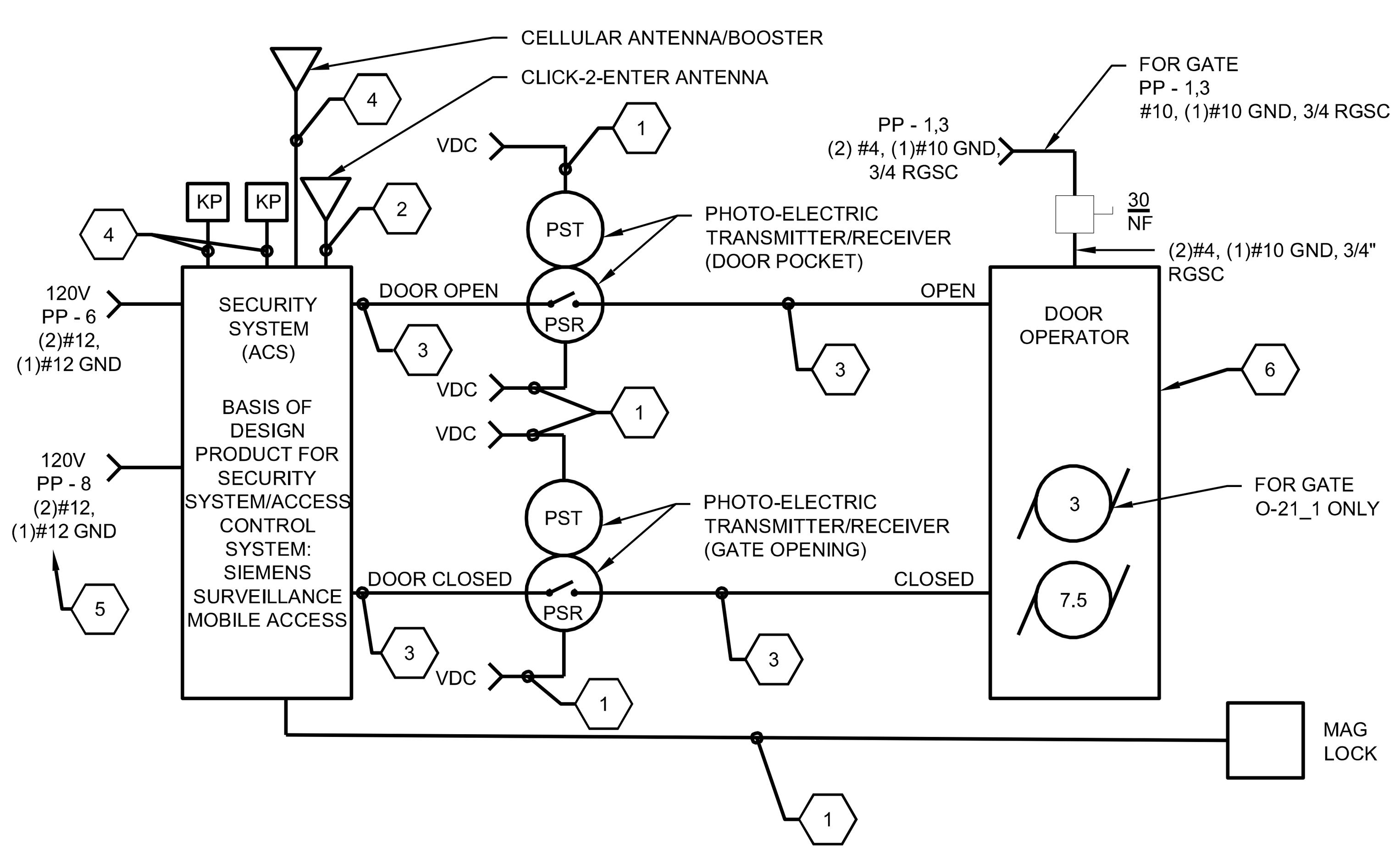
1. 2 #12 (POWER) FROM SECURITY PANEL
2. 2 #12 (POWER) + 2 #16 (DOOR OPEN SIGNAL)
3. 2 #16 (CONTROL)
4. SPECIALITY CABLE PER MANUFACTURER
5. POWER FOR CELLULAR ANTENNA BOOSTER. EXTEND CONDUCTORS/CONDUIT TO DEVICE LOCATION.
6. BASIS OF DESIGN PRODUCT FOR DOOR OPERATOR IS: DOOR KING 9575 W/ HEAVY DUTY HOUSING OPTION.
7. CONNECT TO ONE FIXTURE NEAREST TO PANELS (LANDSIDE)

LUMINAIRE SCHEDULE

TYPE	GENERAL DESCRIPTION	LIGHT SOURCE DATA				DRIVER/BALLAST		POWER DATA		MANUFACTURER AND CATALOG NUMBER SERIES	NOTES
		LAMP TYPE	QTY x WATTS/LAMP	LAMP CODE/LED MODULE	LED DELIVERED LUMENS	CONTROL TYPE	DIMMING	SUPPLY VOLT	WATTS PER FIXT.		
A	DSX1 LED P9 50K T5W MVOLT (LITHONIA LIGHTING)	LED	NA	FURNISHED WITH FIXTURE	28805	NA	0-10V	120V	241	DSX1 LED P9 50K T5W MVOLT (LITHONIA LIGHTING)	

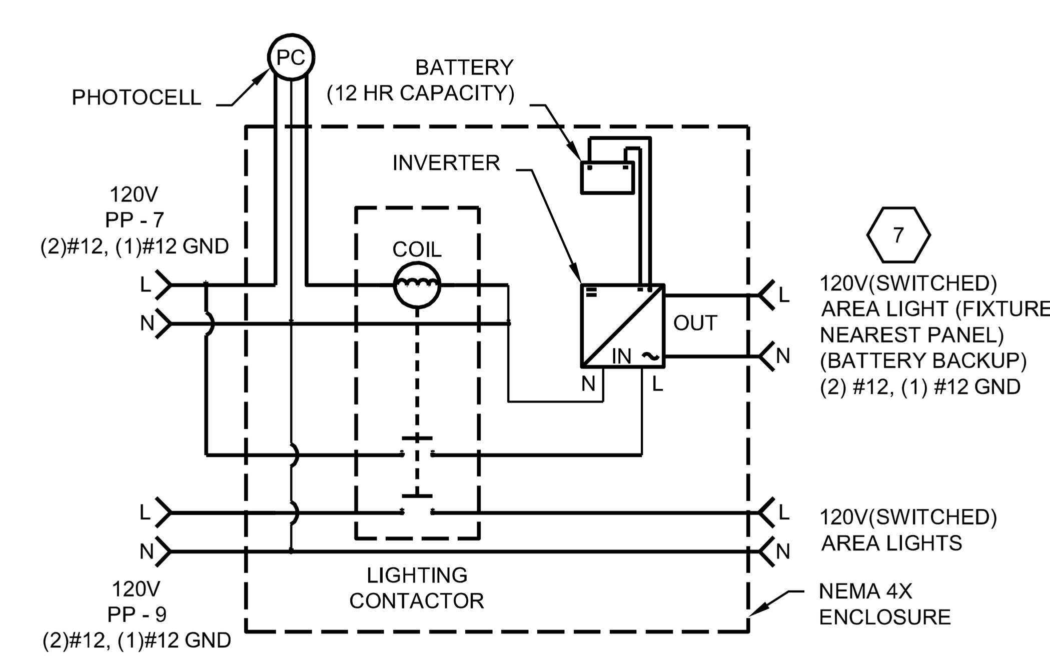
GATE LUMINAIRE SCHEDULE

NO SCALE



GATE CONTROL DIAGRAM

NO SCALE



GATE LIGHTING CONTACTOR DIAGRAM

NO SCALE

US Army Corps of Engineers ®

DATE | DESCRIPTION | MARK

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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE
ELECTRICAL CONTROL SCHEMATIC
50 FT. SINGLE LEAF AUTOMATED GATE

SHEET ID
RGC
E-603

US Army Corps of Engineers ®
GALVESTON DISTRICT

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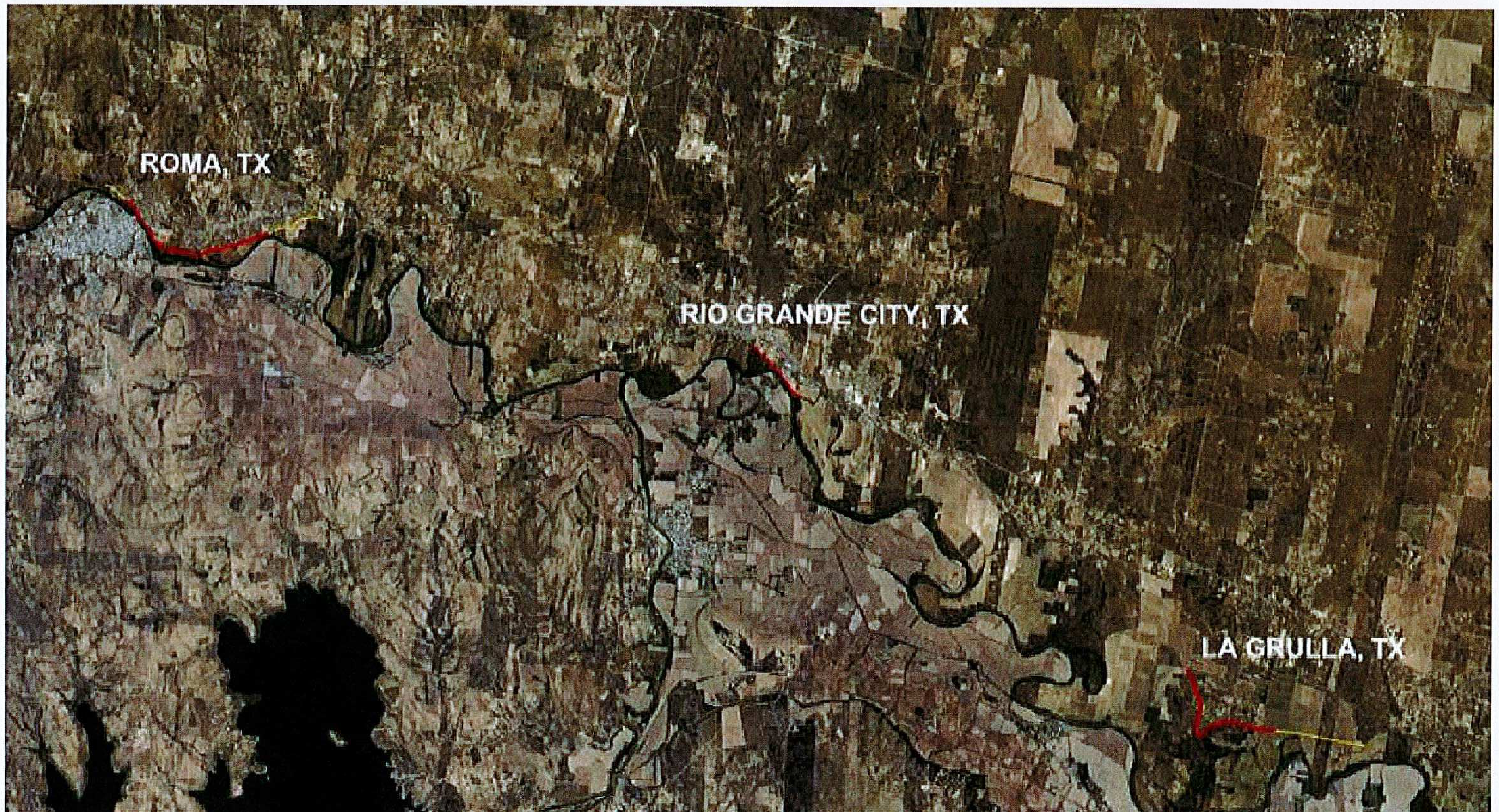
RGV 06 - BORDER INFRASTRUCTURE CONSTRUCTION PROJECT
RIO GRANDE VALLEY (RGV) CONSTRUCTION OF BOLLARD FENCE



LA GRULLA, TEXAS

SOLICITATION NO.:

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

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DRAWN BY:
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SUBMITTED BY:
SIZE: ANSI D
ISSUED DATE:
SOLICITATION NO:
CONTRACT NO:
FILE NUMBER:

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RGV 06 - BORDER INFRASTRUCTURE CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV) CONSTRUCTION OF BOLLARD FENCE

PROJECT LOCATION

SHEET ID
LA GRULLA
G-000

US Army Corps of Engineers ®
GALVESTON DISTRICT

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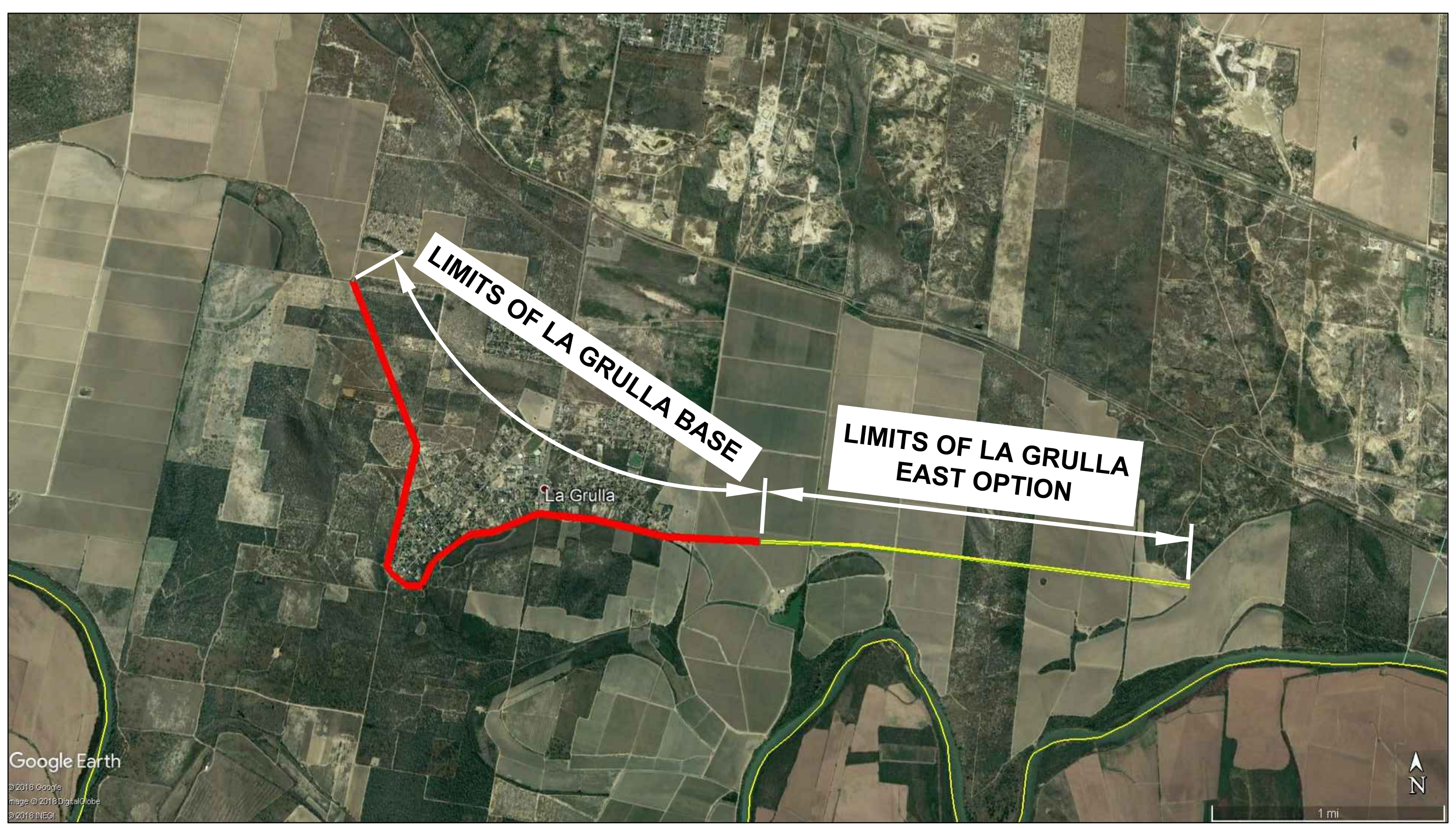
RGV 06 - BORDER INFRASTRUCTURE CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV) CONSTRUCTION OF BOLLARD FENCE LA GRULLA BASE AND EAST OPTION



LA GRULLA, TEXAS

NORTH

SOLICITATION NO.:
CONTRACT NO.:
ISSUE DATE:

INDEX

US Army Corps of Engineers ®

DATE | DESCRIPTION | MARK

ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

DESIGNED BY: A.PONCHAI
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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

COVER SHEET

SHEET ID
LAGRULLA
G-001

ABBREVIATIONS

C	TOTAL CENTRAL ANGLE
Ø	CURVE CENTRAL ANGLE DIAMETER
S	CENTRAL ANGLE
ABUT	ABUTMENT
ADT	AVERAGE DAILY TRAFFIC
AH	AHEAD
APPR.	APPROACH
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
APPROX	APPROXIMATELY
BF	BACK FACE
BK	BACK
BM	BENCH MARK
BP	BALANCE POINT
BR.	BRIDGE
BRG.	BEARING
CC OR C. TO C	CENTER TO CENTERLINE
CLR	CLEAR
CMP	CORRUGATED METAL PIPE
COL	COLUMN
CONC.	CONCRETE
CONN	CONNECTION
CONST.JT OR CJ	CONSTRUCTION JOINT
CONST.	CONSTRUCTION
CONT.	CONTINUATION
CONT.	CONTINUOS
CS	POINT OF CURVE TO SPIRAL
CSA	CEMENT-STABILIZED AGGREGATE
CTRS.	CENTERS
CUFT	CUBIC FOOT (FEET)
CULU	CULVERT
CY,CUYD	CUBIC YARD (S)
D	DEPTH
DIA	DIAMETER
DHV	DESIGN HOURLY VOLUME
DIAG	DIAGONAL
DIAPH.	DIAPHRAGM
DIST	DISTANCE
DRWG(S)	DRAWING(S)
E	EAST
e	SUPERELEVATION RATE ENVIRONMENTAL ASSESSMENT
EA	EACH
EG	EXISTING GROUND
EL.94.16FT	ELEVATION W ITH NUMBER
ELEV.	ELEVATION
EMB.	EMBANKMENT
EP	EDGE OF PAVEMENT
E/P	EDGE OF PAVEMENT
EQ OR EQ.	EQUATION OR EQUAL
ER	EDGE OF ROAD
E/S	EDGE OF SHOULDER
EW	EDGE OF WATER
EX	EXISTING
EXC.	EXCAVATION
EXP. JT.	EXPANSION JOINT
FIN.	FINISH
FF	FRONT FACE
FLG.	FLANGE
FT	FEET/FOOT
FT2.	SQUARE FOOT
FT3	CUBIC FOOT (FEET)
FTG.	FOOTING
GA	GAGE (GAUGE)
GALV.	GALVANIZED
H	HEIGHT
HDWL.	HEADWALL
HEX	HEXAGON
HORZ	HORIZONTAL
HW	HIGH WATER
ID	INSIDE DIAMETER
IN	INCH.INCHES
INFO	INFORMATION
JT	JOINT
L	LENGTH, LENGTH OF CURVE
LAM	LAMINATION
LAT.	LATITUDE
LBS	POUNDS
LNFT	LINEAR FOOT (FEET)
LONG.	LONGITUDINAL
L.P.	LOW POINT
LPSM	LUMP SUM
LS	LENGTH OF SPIRAL
LT.OR.LT	LEFT
LW	LOW WATER
LWC	LOW WATER CROSSING
M.L.	MAIN LINE
M.P.	MILE POST
MATL.	MATERIAL
MAX.	MAXIMUM
MEG.	MATCH EXISTING GRADE
MGAL	THOUSAND GALLON
MIN.	MINIMUM
MON.	MONUMENT
N	NORTH, NORTHING
N/A	NOT APPLICABLE
NC	NORMAL CROWN

NTS	NOT TO SCALE
O.C.	ON CENTER
O.TO O.	OUT TO OUT
OD	OUTSIDE DIAMETER
OG	ORIGINAL GROUND
PC	POINT OF CURVE
PCC	POINT OF COMPOUND CURVE PORTLAND CEMENT CONCRETE
PCS	POINT OF CURVE TO SPIRAL
PF	PEDESTRIAN FENCE
PI	POINT OF INTERSECTION
PIP	PROTECT IN PLACE
PL.	PLATE
POB	POINT OF BEGINNING
POC	POINT OF CURVE
POE	POINT OF ENTRY POINT OF ENDING
POS	POINT OF SPIRAL
POT	POINT OF TANGENT
PS	POINT OF TANGENT SPIRAL
PSC	POINT OF SPIRAL CURVE
PSI	POUND PER SQUARE INCH
PST	POINT OF SPIRAL TANGENT
PT	POINT OF TANGENT
PVMT.	PAVEMENT
PVC	POINT OF VERTICAL CURVATURE
PVI	POINT OF VERTICAL INTERSECTION
PVT	POINT OF VERTICAL TANGENT
STD	STANDARD
STGR	STRINGER
STIFF.	STIFFENER
STRUCT.	STRUCTURAL
STS	POINT OF SPIRAL TO TANGENT SPIRAL
SYM.	SYMMETRICAL
T	TANGENT DISTANCE
T.	TOWNSHIP
TBD.	TO BE DETERMINED
TBM	TEMPORARY BENCH MARK
TH	THICKNESS
THD	THREAD
TS	POINT OF TANGENT TO SPIRAL
TS	TANGENT DISTANCE (SPIRALED CURVE)
TYP.	(TYPICAL)
UNO	UNLESS NOTED OTHERWISE
V	DESIGN SPEED
VERT	VERTICAL
VF	VEHICULAR FENCE
VPH	VEHICLE PER HOUR
VPI	VERTICAL POINT OF INTERSECTION
W	WEST
W/	WITH
WSE	WATER SURFACE ELEVATION
WTR	WATER
YDS	SQUARE YARD
YD3	CUBIC YARD(S)

GENERAL SYMBOLS LIST

	BREAK LINE
	TREE LINE
Cx	OVERHEAD COMMUNICATION LINE
Cx	UNDERGROUND COMMUNICATION LINE
SDx	STORM DRAINAGE LINE
	WATER OR IRRIGATION LINE (24" & SMALLER LINE)
X	EXISTING BARBED WIRE FENCE
E	EXISTING ELECTRIC (OVERHEAD)
E	ELECTRIC (UNDERGROUND)
O	OIL OR PETROLEUM LINE
	TELEPHONE LINE
Wx	EXISTING WATER LINE
	SURVEY CONTROL MONUMENT
	SIGN
	DITCH
	DITCH CENTER LINE
	ROADWAY
R/W	CONSTRUCTION LINE
	CONSTRUCTION LIMITS
	PROPERTY LINE
	EDGE OF EXISTING ASPHALT
	FIRE HYDRANT
	DOWN GUY
	TELEPHONE/SIGNAL PULL BOX
	PROPERTY CORNER
	CULVERT
CP	PIPE CULVERT
	PULL BOX FOR POWER/CONTROL
	PULL BOX FOR TELEPHONE/INSTRUMENTATION
	POSSIBLE KEY PAD LOCATION
	GATE PIER FOUNDATION
R.O.W.	RIGHT-OF-WAY
	TRAFFIC FLOW PATTERN
	EXISTING RETAINING WALL
	PROPOSED GATE
	EXISTING BORDER FENCE CORNER
31	EXISTING CONTOUR
34	PROPOSED CONTOUR
	PROPOSED BOLLARD FENCE
SF	SILT FENCE
MAIL	MAILBOX
GP	GUARD POST (BOLLARD)
	BOREHOLE
PP/XFMR	POWER POLE WITH TRANSFORMER
PIPE	VERTICAL PIPE
CDC	COMMUNICATION DROP CONNECTION
C-RISER	COMMUNICATION RISER
C-UNG	UNDERGROUND COMMUNICATION MARKER
CAM	SECURITY CAMERA
	UTILITY POLE
EDC	ELECTRIC DROP CONNECTION
	GROUND ROD
	LIGHT POLE, PULLBOX AND LIGHTING
	LIGHT
	LIGHT POLE
XXX	ELECTRIC METER
	ELECTRIC PANEL
S	SWITCH
	JUNCTION BOX
WV	WATER VALVE
W	WATER METER
IV	IRRIGATION VALVE
	EVERGREEN TREE
	DECIDUOUS TREE
	ASPHALT ROADWAY
	CONCRETE
	AGGREGATE ROADWAY

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

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DESIGNED BY: X
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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

ABBREVIATIONS

SHEET ID
LAGRULLA
G-002

GENERAL:

1. ANY AND ALL DAMAGE TO EXISTING ROADS, CONCRETE LINED DITCH, FENCE UTILITIES AND ALL OTHER EXISTING STRUCTURES RESULTING FROM THE CONTRACTOR'S CONSTRUCTION SHALL BE REPLACED AND REPAIRED TO ORIGINAL CONDITION OR BETTER AND TO THE SATISFACTION OF THE COR AT THE EXPENSE OF THE CONTRACTOR.

2. IF MATERIALS, QUANTITIES, STRENGTHS OR SIZES INDICATED BY THE DRAWING OR SPECIFICATIONS ARE NOT IN AGREEMENT WITH THESE NOTES, THE BETTER QUALITY AND / OR GREATER QUANTITY, STRENGTH OR SIZE INDICATED, SPECIFIED, OR NOTED SHALL BE PROVIDED.

3. IT IS SOLELY THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE ERECTION PROCEDURE AND SEQUENCE TO INSURE THE SAFETY OF THE STRUCTURE AND ITS COMPONENT PARTS DURING ERECTION. THIS INCLUDES, BUT NOT LIMITED TO,THE ADDITION OF WHATEVER TEMPORARY BRACING, SHORING, GUYS OR TIE-DOWNS THAT MAY BE NECESSARY. SUCH MATERIAL SHALL BE REMOVED AND SHALL REMAIN THE PROPERTY OF THE CONTRACTOR AFTER COMPLETION OF THE PROJECT.

4. THE CONTRACTOR , AT HIS OWN EXPENSE, SHALL RESPOND TO COMPLAINTS REGARDING DUST AND NOISE POLLUTION RESULTING FROM HIS WORK.

5. THE CONTRACTOR SHALL PROVIDE SAFE ACCESS TO AND FROM ALL DRIVEWAYS AND STREETS, PAVED OR UNPAVED, AT ALL TIMES DURING CONSTRUCTION.

6. THE CONTRACTOR SHALL VERIFY AND CHECK ALL DIMENSIONS, LOCATIONS, ELEVATIONS AND DETAILS SHOWN ON THESE DRAWINGS PRIOR TO START OF CONSTRUCTION. ANY UNCERTAINTIES AND DISCREPANCIES SHALL BE IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE CONTRACTING OFFICER FOR CLARIFICATION PRIOR TO COMMENCING THAT WORK FEATURE..

7. THE PROJECT SHALL BE SECURED AT ALL TIMES DURING CONSTRUCTION.

8. THE CONTRACTOR SHALL DISPOSE OF ALL CONSTRUCTION DEBRIS AND OTHER WASTE MATERIAL OFF THE GOVERNMENT OWNED LAND AT AN APPROVED OFF-SITE DISPOSAL AREA IN ACCORDANCE WITH APPLICABLE REGULATORY AGENCY REQUIREMENTS. ALL PERMITS REQUIRED FOR OFF-SITE DISPOSAL SHALL BE OBTAINED BY THE CONTRACTOR.

9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COMPLIANCE WITH AND THE ENFORCEMENT OF ALL APPLICABLE SAFETY REGULATIONS. ACCORDING TO EM 385-1-1 SAFETY AND HEALTH REQUIREMENTS MANUAL.

10. IN CASE OF DISCREPANCY BETWEEN THE SPECIFICATIONS AND CONSTRUCTION DOCUMENTS, THE MORE STRINGENT SHALL APPLY.

11. DURING CONSTRUCTION, STRUCTURE MAY BE BUOYANT. IN THE EVENT OF FAILURE OF DEWATERING SYSTEM AND THE EXCAVATION BECOMES FLOODED OR THE SURROUNDING GROUND BECOMES SATURATED. THE CONTRACTOR SHALL SUBMIT A PLAN TO PREVENT FLOATING OF THE STRUCTURE.

12. ALL WORK SHALL BE COMPLETED TO THE SATISFACTION OF THE USACE, DHS AND USIBWC.

13. THE CONTRACTOR SHALL PRESERVE AND PROTECT OR REMOVE (WITH PRIOR WRITTEN APPROVAL OF AFFECTED PROPERTY OWNER'S) ALL TREES, SHRUBS, HEDGES, RETAINING WALLS. LANDSCAPING, BUILDINGS, WALKS,ETC..., IN OR NEAR CONSTRUCTION AREA. CONTRACTORS SHALL TRIM AND / OR CUT AS NECESSARY ANY TREE OR BRANCH WITHIN OR EXTENDING INTO THE ENFORCEMENT ZONE IN ORDER TO PROVIDE A CLEAR ZONE.

14. INTERMITTENT SURVEY MONUMENTS MAY BE UNCOVERED DURING FENCE REMOVAL THAT ARE NOT SHOWN ON THE PLANS. THESE MONUMENTS SHALL BE PROTECTED IN PLACE. REALIGN FENCE AROUND MONUMENT TO CLEAR CONCRETE MONUMENT FOOTING (3 FEET OFFSET NOT REQUIRED).

15. THE CONTRACTOR SHALL COORDINATE WITH PRIVATE LANDOWNERS TO MAINTAIN ACCESS TO PRIVATE PROPERTY DURING CONSTRUCTION.

16. CONTRACTOR MAXIMUM SPEED THROUGH THE CONSTRUCTION FOR BORDER PATROL MUST ALWAYS BE ALLOWED.

17. UNOBSTRUCTED ACCESS THROUGH THE CONSTRUCTION FOR BORDER PATROL MUST ALWAYS BE ALLOWED.

18. CONTRACTOR SHALL HIRE A PROFESSIONAL GEOTECHNICAL ENGINEER TO PROVIDE INSPECTION OF EXCAVATIONS AND SOIL/GROUNDWATER CONDITIONS THROUGHOUT CONSTRUCTION. THE GEOTECHNICAL ENGINEER IS RESPONSIBLE FOR PERFORMING PRE-CONSTRUCTION AND PERIODIC SITE VISITS THROUGHOUT CONSTRUCTION TO ASSESS THE SITE CONDITIONS. ALL COMMUNICATION WITH THE CONTRACTOR WILL BE COORDINATED WITH AND THROUGH THE CONTRACTING OFFICER OR COR TO CHANGE OR CLARIFY THE CONTRACT DOCUMENTS. THE CONTRACTOR WILL BE REQUIRED TO PROVIDE 24-HOUR ADVANCE NOTICE TO THE COR AS WELL AS A WRITTEN SUMMARY REPORT TO COR, WITH REGARD TO ANY SITE VISIT THAT IS COMPLETED BY THE CONTRACTOR'S GEOTECHNICAL ENGINEER.

19. ALL UTILITIES LOCATIONS ARE APPROXIMATE AND TO BE VERIFIED BY THE CONTRACTOR. IT IS THE CONTRACTOR'S RESPONSIBILITY TO IDENTIFY AND LOCATE ALL EXISTING UNDERGROUND AND OVERHEAD UTILITIES PRIOR TO THE START OF DESIGN CONSTRUCTION.

20. CONTRACTOR SHALL MAINTAIN ALL BARBED WIRE FENCES STANDING AT ALL TIMES AND SHALL REPAIR OR REPLACE IF DAMAGED AT CONTRACTOR'S EXPENSE. CONTRACTOR SHALL CLOSE ALL OPEN AREAS WHERE FENCE IS REMOVED WITH BARBED WIRE TO PREVENT CATTLE CROSSING ON THE BORDER. CONTRACTOR SHALL GUARANTEE THAT NO CATTLE WILL CROSS INTO THE US DURING CONSTRUCTION.

21. ALL BORDER MONUMENTS SHALL BE PROTECTED IN PLACE.

22. DESIGN LOADS
    WIND LOAD:
    - BASIC WIND SPEED 116 MPH
    - EXPOSURE C

    EARTHQUAKE DESIGN DATA
    - SPECTRAL RESPONSE ACCELERATION. Ss 0.044
    - SPECTRAL RESPONSE ACCELERATION. S1 0.013
    - SITE CLASS D
    - SPECTRAL RESPONSE ACCELERATION. SDS 0.044
    - SPECTRAL RESPONSE COEFFICIENT. SD1 0.023
    - SEISMIC DESIGN CATEGORY. SD1 A

23. THE CONTRACTOR'S TRAFFIC CONTROL PLAN SHALL CONFORM TO THE MORE STRINGENT REQUIREMENT(S) OF TXDOT AND EM385-1-1 REQUIREMENTS.

DEMOLITION AND STRUCTURAL STEEL REMOVAL:

1. THE CONTRACTOR SHALL REMOVE AND DISPOSE OF ALL ITEMS CALLED FOR IN THE PLANS AT AN APPROVED OFF-SITE LOCATION.

2. SEE SECTION 02 41 00 DEMOLITION FOR ADDITIONAL INFORMATION.

3. AT SEVERAL LOCATIONS, ITEMS, SUCH AS BUT NOT LIMITED TO TRAFFIC SIGNS AND MEMORIAL ITEMS, ARE ATTACHED TO THE EXISTING FENCING, IF SUCH ITEMS ARE NOT REMOVED BY LOCAL AUTHORITIES PRIOR TO FENCE DEMOLITION CONTRACTOR SHALL REMOVE SUCH ITEMS AND TURN THEM OVER TO THE COR.

4. AT ALL WASHES, WASH NUMBER SIGNS THAT ARE WELDED TO EXISTING FENCING SHALL BE REMOVED AND TURNED OVER TO COR TO GIVE BORDER PATROL. CONTRACTOR SHALL COORDINATE THROUGH COR WITH BORDER PATROL TO PLACE BACK ONTO NEW FENCE.

CLEARING AND GRUBBING:

1. PRIOR TO GENERAL SITE GRADING, AREAS TO RECEIVE NEW STRUCTURES SHALL BE STRIPPED OF ANY EXISTING STRUCTURES AND VEGETATION.

2. CONTRACTOR SHALL BE RESPONSIBLE FOR TRIMMING AND REMOVAL OF TREE OBSTRUCTING FENCE REPLACEMENT. FOR TREES ROOTED IN MEXICO THAT REQUIRE TRIMMING, CONTRACTOR SHALL COORDINATE WITH THE COR PRIOR TO CONDUCTING WORK.

3. WASTE MATERIALS INCLUDING VEGETATION, ROOTS, CONCRETE, SLURRY AND DEBRIS SHALL BE DISPOSED OF OFF-SITE BY CONTRACTOR.

EXISTING UTILITIES:

1. LOCATIONS OF UNDERGROUND UTILITIES ARE FROM BEST INFORMATION AVAILABLE AT THE TIME THESE PLANS WERE PREPARED. THE GOVERNMENT DOES NOT WARRANT THE ACCURACY OF THE INFORMATION AVAILABLE AT THE TIME THESE PLANS WERE PREPARED. THE GOVERNMENT DOES NOT WARRANT THE ACCURACY OF THE INFORMATION PROVIDED. ANY DEVIATION SHALL BE CALLED TO THE ATTENTION OF THE COR PRIOR TO PROCEEDING WITH WORK IN THE AREA OF FOUND UTILITIES.

2. APPROXIMATE LOCATIONS OF KNOWN EXISTING UTILITIES ARE SHOWN. CONTRACTOR SHALL DETERMINE THE EXACT HORIZONTAL AND VERTICAL LOCATIONS IN THE FIELD PRIOR TO COMMENCING WORK. CONTRACTOR TO BE FULLY RESPONSIBLE FOR DAMAGES WHICH MIGHT OCCUR BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE EXISTING UTILITIES AND /OR STRUCTURES.

3. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO HAVE ALL UTILITIES LOCATED AND MARKED PRIOR TO THE START OF CONSTRUCTION. ANY FOUND UTILITIES NOT STATED ABOVE SHALL BE BROUGHT TO THE ATTENTION OF THE COR FOR DIRECTION. PRIOR TO PROCEEDING WITH CONSTRUCTION IN THE AREA OF SAID UTILITIES.

4. PUBLIC AND PRIVATE UTILITY LINES AND CUSTOMER SERVICE LINES MAY EXIST THAT ARE NOT SHOWN ON THE CONSTRUCTION DRAWINGS. IT SHALL BE CONTRACTOR'S RESPONSIBILITY TO LOCATE, MAINTAIN AND PROTECT THE INTEGRITY OF THESE LINES. HAND EXCAVATION MAY BE REQUIRED.

5. CONTRACTOR SHALL COORDINATE WITH THE APPROPRIATE UTILITY COMPANY TO RELOCATE OR DIVERT ANY UTILITY IN CONFLICT WITH PROPOSED CONSTRUCTION SO AS NOT TO DISRUPT SERVICE OF IT. CONTRACTOR SHALL RESTORE, RELOCATED OR DIVERT UTILITY TO ITS ORIGINAL CONDITION AND LOCATION WHEN APPLICABLE UPON COMPLETION OF CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO MAKE ALL UTILITY ADJUSTMENTS AND ACQUIRE ALL REQUIRED PERMITS FOR RELOCATION.

6. THE VERIFIED LOCATIONS OF ALL UTILITIES SHALL BE DEPICTED ON THE WORKING RECORD DRAWINGS AND FINAL AS-BUILT DRAWINGS.

7. CONTACT THE CITY OF LAGRULLA AT (956) 487-3341 FOR UTILITY LOCATES WITHIN THE LIMITS OF CONSTRUCTION.

DRAINAGE:

6. CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ADEQUATE DRAINAGE AT ALL TIMES DURING CONSTRUCTION OF PROPOSED FACILITIES.

7. CONTRACTOR SHALL PROVIDE POSITIVE DRAINAGE AT ALL TIMES DURING THE INSTALLATION OF THE STRUCTURES AND DRAINAGE IMPROVEMENTS.

SWPPP:

1. IMPLEMENT SWPPP AS REQUIRED BY TCEQ REQUIREMENTS AND PROJECT SPECIFICATIONS PRIOR TO CONSTRUCTION IMPLEMENT BEST MANAGEMENT PRACTICES (BMPS) DESCRIBED IN THE SWPPP TO REDUCE EROSION. SEE SECTION 01 57 19 ENVIRONMENTAL CONTROLS.

2. THE CONTRACTOR SHALL ENSURE THAT BMPS ARE IN PLACE PRIOR TO AND DURING CONSTRUCTION OF THE FENCE. THE CONTRACTOR IS RESPONSIBLE TO ENSURE THAT EROSION AND SEDIMENT CONTROL MEASURES COMPLY WITH FEDERAL, STATE AND LOCAL REGULATIONS.

3. THE CONTRACTOR SHALL PROVIDE ONE SWPPP REPORT AND PLANS FOR CONSTRUCTION OF THE BASE BID AND OPTION ITEMS. PRIOR TO START OF CONSTRUCTION, THE CONTRACTOR SHALL OBTAIN A NOTICE OF INTENT AND COMPLETE THE NOTICE OF ENDING UPON COMPLETION.

4. THE COR RESERVES THE RIGHT TO REQUIRE THE CONTRACTOR TO MODIFY OR REVISE THE SWPPP TO ENSURE THAT ALL CURRENT MEASURES TO PREVENT OFF-SITE MIGRATION OF POLLUTANTS, INCLUDING SOILS, ARE INCLUDED IN THE SWPPP. IF SWPPP DOES NOT ADEQUATELY ADDRESS APPLICABLE BMPS OR IF THE CONTRACTING OFFICER DETERMINES THAT THE STORM WATER POLLUTION PREVENTION REQUIREMENTS ARE NOT BEING MET.

TUNNELS:

1. IN THE EVENT THAT AN UNDERGROUND TUNNEL OR VOID IS DISCOVERED DURING EXCAVATION, THE DESIGN - BUILD CONTRACTOR SHALL IMMEDIATELY CONTACT THE COR AND BORDER PATROL. THE DESIGN - BUILD CONTRACTOR SHALL INCLUDE THE LOCATION(S) AND DIMENSIONS OF ANY TUNNELS DISCOVERED ON BOTH THE WORKING RECORD DRAWINGS AND FINAL AS-BUILT DRAWINGS.

2. THE LOCATIONS OF ALL TUNNELS DISCOVERED SHALL BE DEPICTED ON THE WORKING RECORD DRAWINGS AND FINAL AS-BUILT DRAWINGS.

SEDIMENT CONTROL:

1. CONTRACTOR SHALL PROVIDE AND MAINTAIN SEDIMENT CONTROL SERVICES IN ACCORDANCE WITH THE CONTRACT DOCUMENT THROUGH THE TERM OF THE WORK COVERED BY HIS CONTRACT. SEE SECTION 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

ON-SITE FILL:

1. SOIL EXCAVATED FROM THE PROJECT SITE SHALL BE CONSIDERED ON -SITE FILL.

2. ON-SITE FILL REQUIRED TO BRING THE SITE TO GRADE SHALL BE FREE OF VEGETATION AND DEBRIS, AND CONTAIN NO ROCKS OR LUMPS LARGER THAN 3 INCH NOMINAL DIAMETER.

3. EXCAVATED ON-SITE SOILS MEETINGS THE REQUIREMENTS FOR ENGINEERED FILL MAY BE REUSED AS ENGINEERED FILL.

4. EXCAVATED ON-SITE SOILS NOT MEETING THE REQUIREMENTS FOR ENGINEERED FILL MAY BE REUSED FOR FILL WITHIN THE ENFORCEMENT ZONE TO ADJUST GRADE PROVIDED IT DOES NOT CONTAIN ROOTS, ORGANICS, TRASH, DELETERIOUS, UNSUITABLE OR UNSATISFACTORY MATERIAL AS DEFINED BY USIBWC LEVEE CONSTRUCTION GUIDELINES, AND SECTION 31 00 00 EARTHWORK PLAN SPECIFICATIONS, INCLUDING COHESIONLESS MATERIAL (SP SW SM GC GM GP GW)

5. EXCAVATED ON-SITE SOILS NOT MEETING THE REQUIREMENTS FOR ENGINEERED FILL MAY BE MODIFIED / CONDITIONED EITHER THROUGH LIME STABILIZATION OR BLENDING TO MEET THE REQUIREMENTS FOR ENGINEERED FILL AND USED WITHIN THE PROJECT SITE PROVIDED IT DOES NOT CONTAIN ROOTS, ORGANICS, DELETERIOUS OR UNSATISFACTORY MATERIALS AS DEFINED BY USIBWC LEVEE CONSTRUCTION GUIDELINES AND SECTION 31 00 00 EARTHWORK PLAN SPECIFICATIONS. ITS IS ESTIMATED 4% HYDRATED LIME WILL BE REQUIRED TO RAISE THE PH AND CONDITION ON-SITE-HIGH PLASTICITY CLAYS. TESTING WILL BE REQUIRED DURING CONSTRUCTION TO VALIDATE THE ESTIMATE. THE CONTRACTOR SHOULD BE AWARE THAT SOIL PROPERTIES VARY WITHIN THE PROJECT SITE, AND THE QUANTITY OF LIME ESTIMATED TO CONDITION THE ON-SITE SOILS MAY CHANGE.

6. EXISTING CALICHES /AGGREGATE SURFACE COURSE EXCAVATED FROM THE EXISTING ROAD MAY NOT BE REUSED AS AGGREGATE SURFACE COURSE FOR THE NEW PATROL ROAD OR CREST ROAD. EXISTING CALICHE/AGGREGATE SURFACE COURSE MAY BE REUSED AS FILL WITHIN THE ENFORCEMENT ZONE,OR USED AS SUBBASE MATERIAL WITHIN THE PATROL ROAD TO REDUCE THE AGGREGATE SURFACE MATERIAL WITHIN THE PATROL ROAD TO REDUCE THE AGGREGATE SURFACE COURSE REQUIREMENTS. SEE ALL WEATHER ROAD (SEE CIVIL NARRITIVE), PROVIDED IT DOES NOT CONTAIN ROOTS, ORGANICS, DELETERIOUS OR UNSATISFACTORY MATERIAL AS DEFINED BY USIBWC LEVEE CONSTRUCTION GUIDELINES, AND SECTION 31 00 00 EARTHWORK PLAN SPECIFICATIONS.

7. NO ON-SITE FILL SHALL BE PLACED ON OR AGAINST CONCRETE LESS THAN 7 DAYS AFTER PLACEMENT OR 70 PERCENT OF THE DESIGN STRENGTH WITHOUT PRIOR APPROVAL OF THE CONTRACTING OFFICER. CRAWLER-TYPE TRACTORS,VIBRATORY EQUIPMENT AND OTHER SIMILAR COMPACTION EQUIPMENT SHALL NOT BE USED WITHIN 4 FEET OF ANY COMPLETED OR PARTIALLY COMPLETED STRUCTURE. COMPACTION WITHIN 4 FEET OF COMPLETED OR PARTIALLY COMPLETED STRUCTURES SHALL BE ACCOMPLISHED BY THE USE OF MECHANICAL HAND TAMPERS, VIBRATING PLATES, OR OTHER APPROVED METHODS AND EQUIPMENT. FILL MATERIAL SHALL BE COMPACTED TO AT LEAST 95% OF THE MAXIMUM DRY DENSITY WITHIN ±3% OF THE OPTIMUM MOISTURE CONTENT IN ACCORDANCE WITH ASTM D 698. CONTRACTOR WILL ENSURE THAT COMPACTION OPERATIONS DO NOT DAMAGE ANY EXISTING UTILITIES OR STRUCTURE. ANY DAMAGE CAUSED BY THE CONTRACTOR'S OPERATION SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE..

8. FILL PLACED ON ENGINEERED FILL OR NATURAL SLOPES STEEPER THAN 5H:1V SHALL BE KEYED AND BENCHED INTO EXISTING SLOPE. THE BENCHES SHALL BE WIDE ENOUGH TO ACCOMMODATE THE COMPACTION EQUIPMENT AND THE LOWEST BENCH SHALL BE THE WIDEST AT A MINIMUM OF 8 TO 10 FEET WIDE. BENCH HEIGHTS SHALL BE A MAXIMUM OF 3 FEET. BENCH WIDTHS AT THE TOP SHALL BE A MINIMUM OF 4 FEET.

EGRESS/INGRESS ROAD AND STAGING AREAS:

1. THE CONTRACTOR MAY USE THE PUBLIC ROADS SHOWN ON THE LOCATION MAP IN THE PLANS FOR INGRESS / EGRESS TO THE PROJECT SITE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING ANY DAMAGE AT THESE LOCATIONS DUE TO CONSTRUCTION.

2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROCURING AND MAINTAINING THE STAGING AREA.

3. SAFE ACCESS THROUGH WORK SITE SHALL BE MAINTAINED AT ALL TIMES. MATERIAL AND EQUIPMENT SHALL NOT BE STAGED SUCH AS TO LIMIT ACCESS THROUGH THE CONSTRUCTION SITE.

4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROCURING AND MAINTAINING THE STOCKPILE AREA. STOCKPILE AREA WILL BE LOCKED OUTSIDE THE FLOOD PLAIN.

5. THE CONTRACTOR SHALL NOT HAVE CONTACT WITH PRIVATE PROPERTY OWNERS FOR EGRESS / INGRESS ACCESS WITHOUT SPECIFIC APPROVAL FROM USACE AND CBP.

EXCAVATION:

1. ALL EXCAVATED MATERIAL IS TO BE REMOVED FROM THE PROJECT PERMANENT EASEMENTS AND STAGING AREAS AND DISPOSES OF AT AN APPROVED DISPOSAL LOCATION. UNLESS OTHERWISE NOTED OR APPROVED FOR USE AS BACK FILL MATERIAL. EXCAVATED MATERIAL SHALL NOT BE STORED IN THE RIVER FLOOD PLAIN.

2. TRUCKS SHALL BE LOADED IN A MANNER SO AS TO AVOID LOSS OF LOADED MATERIAL OR ANY PORTION THEREOF DURING TRANSPORT IN ACCORDANCE WITH STATE LAW.

3. THE CONTRACTOR SHALL, AT HIS/HER OWN EXPENSE, REPAIR ANY HAUL ROAD SURFACE IRREGULARITIES CAUSES BY LOADING OR HAULING OPERATIONS.

4. ALL TEMPORARY EXCAVATIONS MUST COMPLY WITH APPLICABLE LOCAL, STATE AND FEDERAL SAFETY REGULATION.

PREPARED SUBGRADE:

1. DUE TO THE VARIABILITY OF SITE SOILS, ISOLATED AREAS OF THE SUBGRADE MAY REQUIRE OVER-EXCAVATION AND RECOMPACTION TO MITIGATE LOOSE OR DISTURBED SOIL CONDITIONS. SUBGRADE FOR THE ENTIRE BORDER ROAD SHALL BE PROOF ROLLED IN ACCORDANCE WITH SECTION 31 00 00 EARTHWORK, SUBSECTION 3.12.1 PROOF ROLLING. ANY AREAS OBSERVED TO DEFLECT UNDER THE PRESSURE EXERTED BY THE PROOF ROLLING OPERATIONS WILL REQUIRE OVER-EXCAVATION AND REPLACEMENT WITH ENGINEERED FILL.

2. FOR CUT AREAS, CUT PROPOSED ROAD TO GRADE, SCARIFY TOP 8 INCHES OF SUBGRADE AND MOISTURE CONDITION. FOR FILL AREAS, SCARIFY TOP 6 INCHES OF EXISTING GRADE AND MOISTURE AND CONDITION.

3. COMPACT SUBGRADE FOR CUTTING AREAS TO 95% OF ASTM D1557 AT ±2% OF OPTIMUM MOISTURE CONTENT. FILL MATERIAL SHALL BE TESTED IN 8-INCH LOOSE/ COMPACTED TO 6 INCHES UNDER ROADWAYS AND 12-INCH LOOSE/COMPACTED TO 8-INCHES IN OTHER FILL LOCATIONS AND SHALL CARRY SIMILAR SOIL PROPERTIES AS SHOWN ON BORING LOGS. COMPACTION OF FILL MATERIAL IN SUBGRADE SHALL BE TO 95% OF ASTM D1557 AT ±2% OF OPTIMUM MOISTURE CONTENT.

4. SITE GRADING PERFORMED DURING OR SUBSEQUENT TO WET WEATHER MAY RESULT IN NEAR-SURFACE SITE SOILS WITH MOISTURE CONTENTS SIGNIFICANTLY ABOVE OPTIMUM. THIS CONDITION COULD HAMPER EQUIPMENT MANEUVERABILITY AND EFFORTS TO COMPACT SITE SOILS TO THE RECOMMENDED COMPACTION CRITERIA. DURING MOST OF THE YEAR, THE SITE WILL TYPICALLY DRY TO WORKABLE MOISTURE CONTENTS WITHIN 1 TO 2 DAYS. IF TIME IS CRITICAL FACTOR. DISKING FOR AERATION, CHEMICAL TREATMENT, REPLACEMENT WITH DRIER MATERIAL, STABILIZATION WITH GEOTEXTILE FABRIC OR OTHER METHODS MAY BE IMPLEMENTED TO REDUCE EXCESSIVE SOIL MOISTURE AND FACILITATE EARTHWORK OPERATIONS. THIS WILL BE DONE AT NO ADDITIONAL COST TO THE GOVERNMENT. ALL COMMUNICATION WITH CONTRACTOR SHALL BE COORDINATED WITH AND THROUGH THE COR TO CHANGE OR CLARIFY THE CONTRACT DOCUMENTS. ALL FIELD DIRECTIVES WILL BE COORDINATED WITH AND ISSUED BY THE COR.

FOUNDATIONS:

1. FOUNDATIONS SHALL BE CAST ON PROPERLY COMPACTED SOIL. NATIVE SOILS SHALL BE COMPACTED TO AT LEAST 95% TO THE MAXIMUM DRY DENSITY AT ±2% OF OPTIMUM MOISTURE (ASTM D1557).

2. WHERE NATIVE SOILS ARE LOOSE, SATURATED OR UNSTABLE AND DO NOT MEET THE ALLOWABLE BEARING CAPACITY, NATIVE SOILS SHALL BE OVER-EXCAVATED BELOW THE BOTTOM OF THE FOOTING ELEVATION TO SOIL ELEVATION MEETING THE DESIGN PARAMETERS. THE OVER-EXCAVATED AREAS SHALL BE BACK FILLED AND COMPACTED USING ENGINEERED FILL. SEE SECTION 31 00 00 EARTHWORK FOR ADDITIONAL INFORMATION. SOIL CONDITIONS WILL VARY AND HENCE COMPACTION MUST RELATE TO THE TYPE OF MATERIAL.

3. CONTRACTOR SHALL BE PREPARED TO SHORE AND FORM TRENCH FOOTING WHERE LOOSE SOILS ARE ENCOUNTERED.

4. FOUNDATION DETAILS FOR BOLLARDS NEED TO BE SUBMITTED (AFTER A GEOTECHNICAL STUDY IS COMPLETED). FOUNDATION DETAILS MAY FROM ONE LOCATION TO ANOTHER DEPENDING UPON SOIL TYPE.

5. CONTRACTOR SHALL DEVELOP TRENCH DEWATERING PLANS WHERE NECESSARY PRIOR TO FOUNDATION PLACEMENT.

CAST-IN PLACE CONCRETE:

1. ALL CONCRETE STRENGTH SHALL CONFORM TO SECTION 03 30 00 CAST-IN- PLACE CONCRETE. SEE SECTION 03 30 00 CAST-IN -PLACE CONCRETE FOR ADDITIONAL INFORMATION.

2. CONCRETE WORK TO BE COVERED IN ACCORDANCE WITH "THE BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE" ACI 318.

3. CONTRACTOR SHALL REVIEW ALL DRAWINGS FOR SIZE AND LOCATION OF EMBEDDED ITEMS AND SLEEVES REQUIRED. THESE ITEMS SHALL BE FURNISHED AND INSTALLED PRIOR TO PLACEMENT OF CONCRETE.

4. ALL MIXING, HANDLING AND TRANSPORTING, PLACING AND CURING OF CONCRETE SHALL BE IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE AMERICAN CONCRETE INSTITUTE.

5. THE ONLY PERSONS AUTHORIZED TO ADD WATER TO THE CONCRETE TRUCK AT THE JOB SITE ARE THE QC TESTING REPRESENTATIVE. IF APPROVED, THE QC TESTING REPRESENTATIVE IS REQUIRED TO NOTIFY THE COR AND QA TESTING REPRESENTATIVE.

6. ALL EXPOSED EDGES SHALL BE CAST WITH $\frac{3}{4}$ INCH CHAMFERS UNO.

REINFORCING STEEL:

1. REINFORCING STEEL SHALL CONFORM TO SECTION 03 20 00.00 10 CONCRETE REINFORCING. NO TACK WELDING OF REINFORCING SHALL BE PERMITTED. PLACEMENT AND DETAILING OF CONCRETE REINFORCEMENT AND ACCESSORIES SHALL BE IN ACCORDANCE WITH ACI 318 AND ACI SP-66, RESPECTIVELY (LATEST ADDITIONS).

2. REBAR SHALL HAVE A MINIMUM COVER OF 3 INCHES UNLESS OTHERWISE NOTED.

3. HORIZONTAL AND VERTICAL REINFORCING STEEL SHALL BE CONTINUOUS ACROSS CONSTRUCTION JOINTS.

4. CONSTRUCTION JOINTS NOT INDICATED ON THE DRAWINGS SHALL BE MADE AND LOCATED AS NOT TO IMPAIR SIGNIFICANTLY THE STRENGTH OF THE STRUCTURE. CONTRACTORS SHALL SUBMIT LOCATION OF PROPOSED JOINTS IN THE SLABS AND WALLS TO ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION.

STRUCTURAL STEEL:

1. STRUCTURAL STEEL SHALL BE PROCURED BY THE CONTRACTOR IN ACCORDANCE WITH SECTION 05 12 00 STRUCTURAL STEEL.

2. STRUCTURAL STEEL SHALL CONFORM TO SECTION 05 12 00 STRUCTURAL STEEL. SEE SECTION 05 12 00 STRUCTURAL STEEL FOR ADDITIONAL INFORMATION.

3. WELDED CONNECTIONS FOR STRUCTURAL STEEL SHALL CONFORM TO THE LATEST REVISED CODE OF THE AMERICAN WELDING SOCIETY, AWS D1.4.

4. STRUCTURAL STEEL SHALL CONFORM TO THE AISC "SPECIFICATIONS FOR DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDING", LATEST EDITION.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

DESIGNED BY: X
DRAWN BY: X
CHECKED BY: X
SUBMITTED BY: X
SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

GENERAL NOTES

SHEET ID
LAGRULLA
G-003

No.	Description	Station	Latitude	Longtitude
1	Base Start	10+00.00	N26° 17' 01.41"	W98° 39' 41.64"
2	PI	53+66.35	N26° 16' 21.38"	W98° 39' 23.48"
3	PI	82+49.35	N26° 15' 53.54"	W98° 39' 30.50"
4	PI	84+15.91	N26° 15' 52.04"	W98° 39' 29.73"
5	PI	89+33.00	N26° 15' 48.84"	W98° 39' 25.30"
6	PI	92+91.99	N26° 15' 48.83"	W98° 39' 21.36"
7	PI	99+05.42	N26° 15' 54.37"	W98° 39' 18.58"
8	PI	109+28.15	N26° 16' 00.29"	W98° 39' 09.46"
9	PI	114+76.07	N26° 16' 00.77"	W98° 39' 03.47"
10	PI	126+34.16	N26° 16' 04.91"	W98° 38' 51.60"
11	PI	129+90.47	N26° 16' 04.39"	W98° 38' 47.73"
12	PI	139+46.56	N26° 16' 03.29"	W98° 38' 37.30"
13	PI	147+27.37	N26° 16' 01.41"	W98° 38' 28.98"
14	PI	156+32.67	N26° 15' 59.03"	W98° 38' 19.39"
15	Base End/ Option Start	178+91.74	N26° 15' 57.47"	W98° 37' 54.63"
16	PI	202+01.56	N26° 15' 56.24"	W98° 37' 29.30"
17	Option End	279+93.12	N26° 15' 45.31"	W98° 36' 04.57"

E1 FENCE POB, EOP AND PI LOCATIONS
SCALE: NTS

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

DESIGNED BY: X
DRAWN BY: X
CHECKED BY: X
SUBMITTED BY: X
SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
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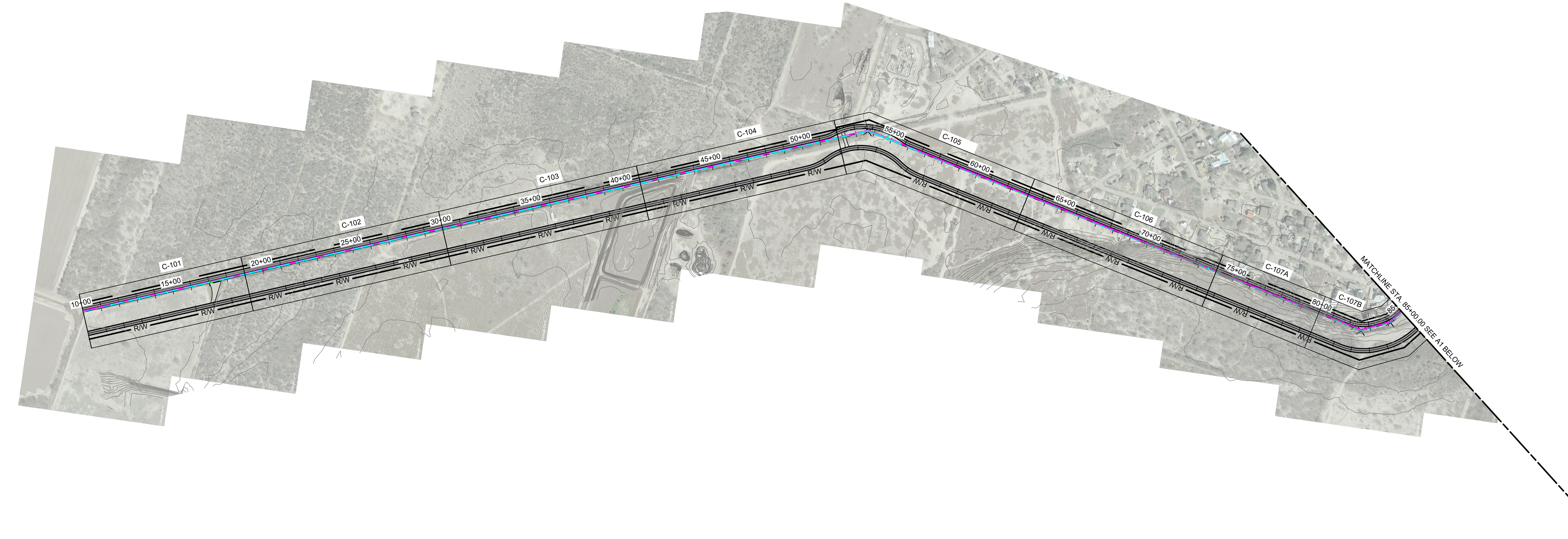
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

FENCE PI LOCATION
STA. 10+00.00 - 279+93.00

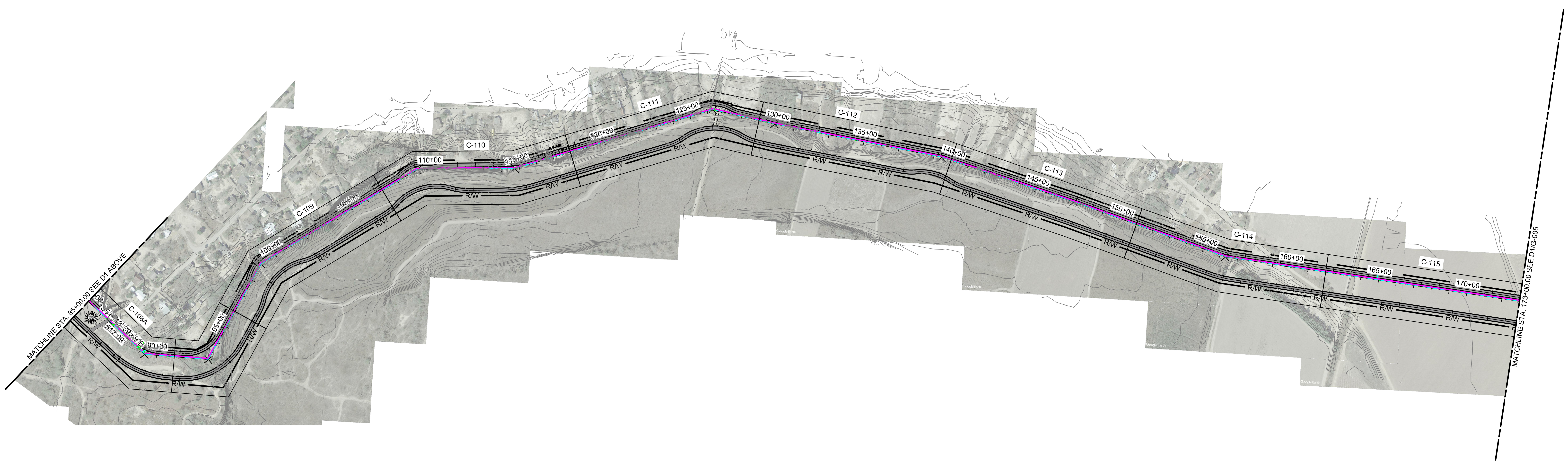
SHEET ID
LAGRULLA
G-006

US Army Corps of Engineers ®



D1 KEYPLAN
SCALE: 1" = 300'-0"

0 300 600 1" = 300' - 0"



A1 KEYPLAN
SCALE: 1" = 300'-0"

0 300 600 1" = 300' - 0"

MARK	DESCRIPTION	DATE

DESIGNED BY: X	ISSUED DATE:
DRAWN BY: X	SOLICITATION NO.:
CHECKED BY: X	CONTRACT NO.:
SUBMITTED BY: X	FILE NUMBER:
SIZE: ANSI D	

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

KEYPLAN
STA. 10+00.00 - 173+00.00

SHEET ID
LAGRULLA
G-004

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

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SUBMITTED BY: X
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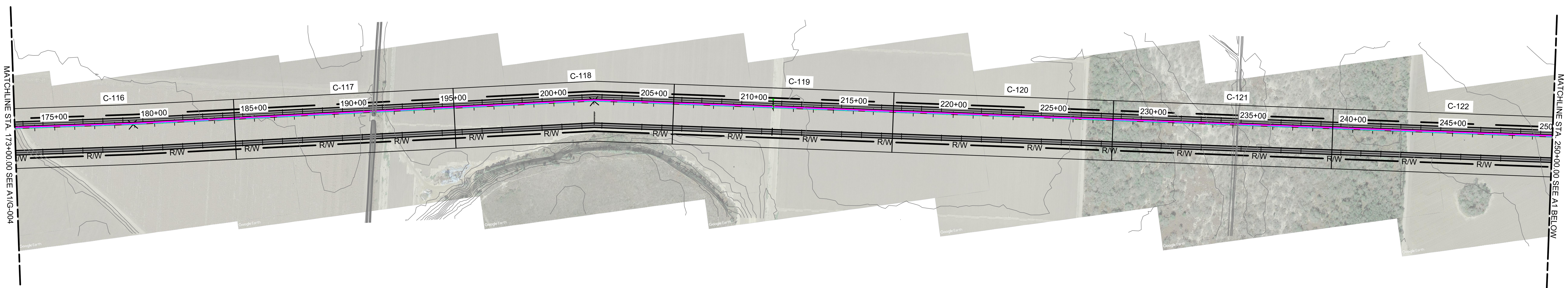
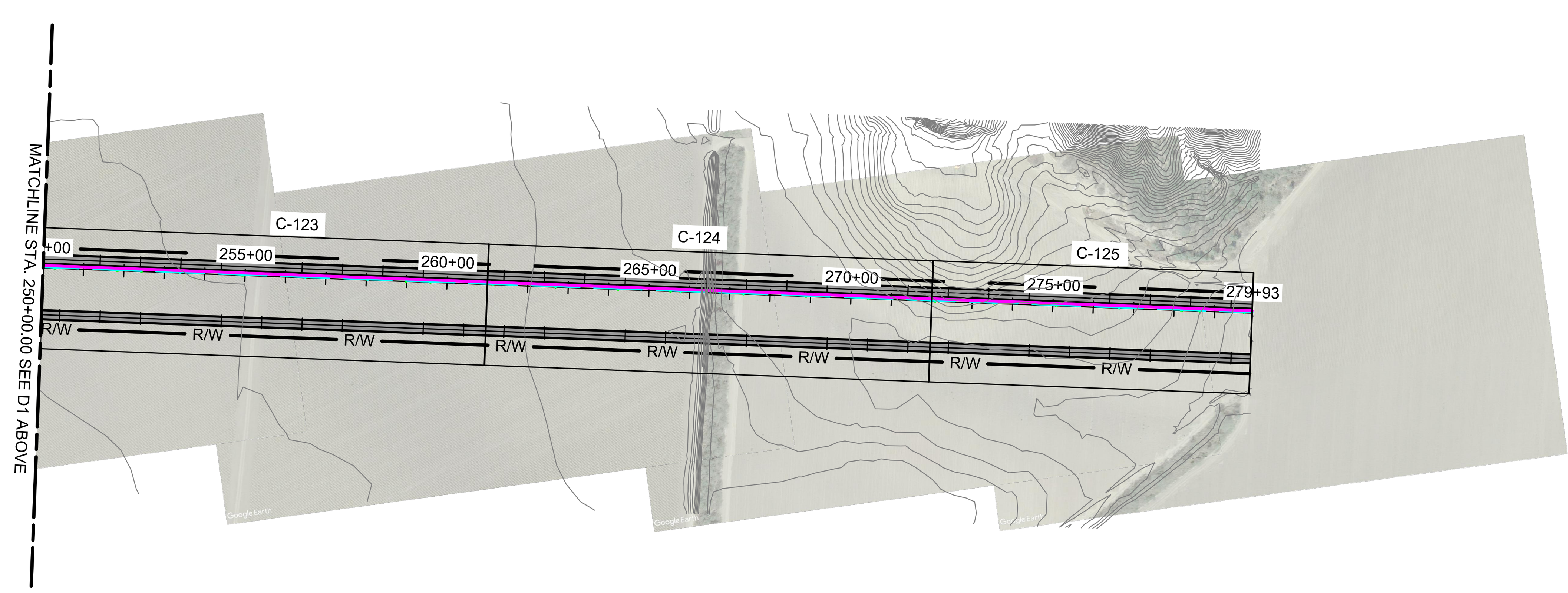


A1 KEYPLAN
SCALE: 1" = 300'-0"

0 300 600 1" = 300' - 0"



A1 KEYPLAN
SCALE: 1" = 300'-0"

0 300 600 1" = 300' - 0"

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
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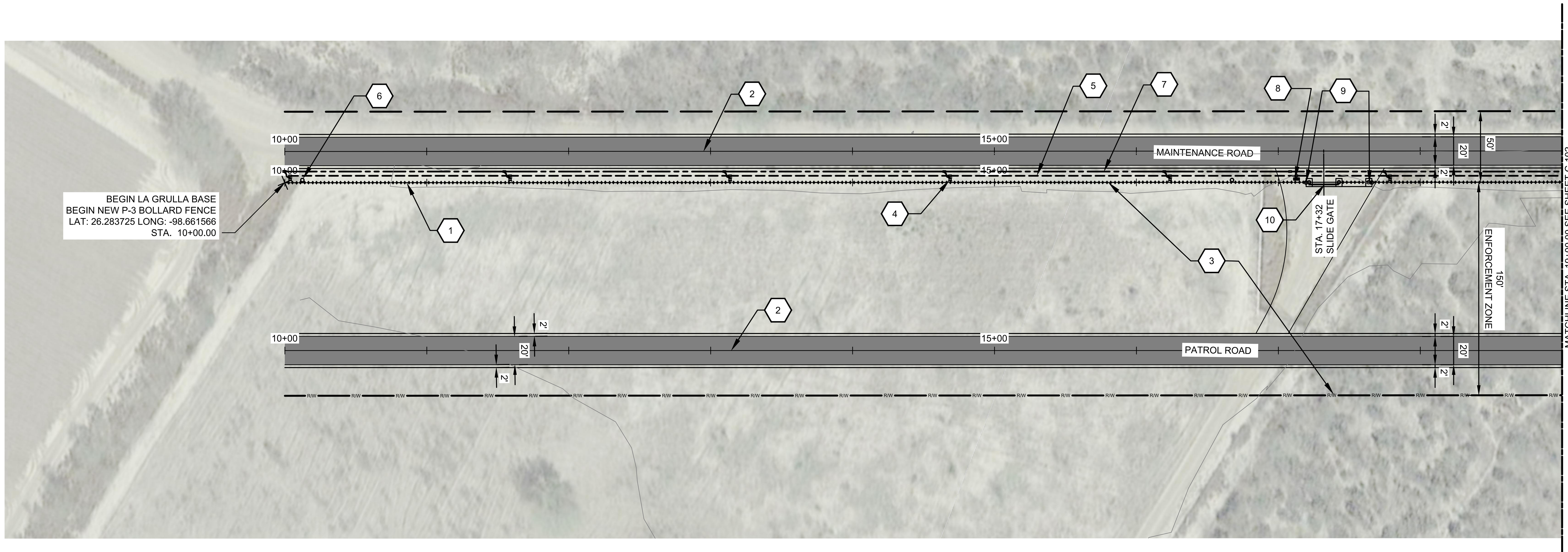
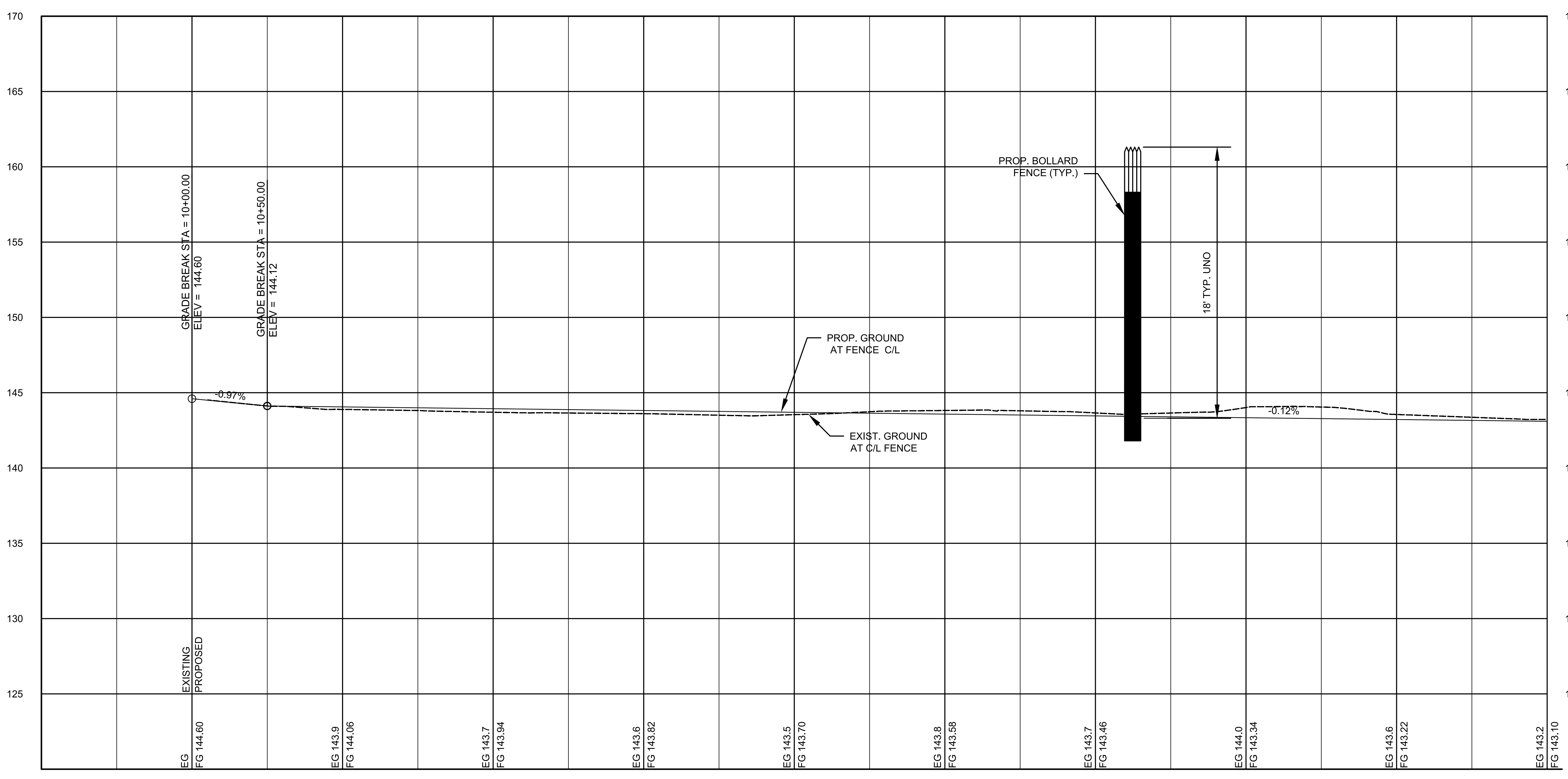
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

KEYPLAN
STA. 173+00.00 - 279+93.00

SHEET ID
LAGRULLA
G-005





A1 PLAN AND PROFILE
SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

0 50 100 1" = 50' - 0"
0 5 10 1" = 5' - 0"

GENERAL NOTES

1. THIS SHEET IS AT 35% CONCEPT DESIGN AND NOT TO BE USED FOR CONSTRUCTION.
2. CONTRACTOR IS RESPONSIBLE FOR PERFORMING ALL GEOTECHNICAL TESTING, TOPOGRAPHIC MAPPING, DESIGN, SURVEY STAKE-OUT, ABOVE AND BELOW GROUND UTILITY IDENTIFICATIONS AND REQUIRED RELOCATIONS, AND REMOVAL AND PROPER DISPOSAL OF STRUCTURES, DEBRIS, ETC. LOCATED WITHIN THE ENFORCEMENT ZONE.
3. CONTRACTOR SHALL ENSURE THAT ALL DESIGNS MEET TACTICAL INFRASTRUCTURE STANDARDS, LATEST EDITION.
4. CONTRACTOR SHALL VERIFY LOCATION OF ALL UTILITIES, IRRIGATION CULVERTS AND DRAINAGE STRUCTURES, AND ADJUST/RELOCATE AS REQUIRED TO DE-CONFLICT WITH THE PROPOSED BOLLARD FENCE AND ENFORCEMENT ZONE (I.E.: EX. IRRIGATION VALVES TO BE RELOCATED TO NORTH LEVEE EMBANKMENT).
5. CONTRACTOR SHALL DESIGN AND INSTALL ALL DRAINAGE SYSTEMS FOR THIS PROJECT.
6. LIGHTING LOCATIONS ARE CONCEPTUAL. CONTRACTOR TO PROVIDE FINAL LIGHTING COMPUTATIONS AND LOCATIONS.

XX KEYNOTES

1. PROPOSED NEW TYPE P-3 BOLLARD FENCE.
2. PROPOSED TYPE FC-2 AGGREGATE ALL-WEATHER ROAD.
3. CLEAR VEGETATION AND GRADE WITHIN ENFORCEMENT ZONE.
4. PROPOSED LIGHT POLE, PULLBOX, AND LIGHTING - SEE ELEC. FOR LOCATIONS (TYP).
5. PROPOSED POWER AND LIGHTING DISTRIBUTION CABLE AND CONDUIT/ DUCT BANK.
6. PROPOSED FENCE GROUNDING LOCATION.
7. PROPOSED COMMUNICATION CONDUIT/ DUCTBANK. (CABLE FUTURE BY OTHERS)
8. GATE ELECTRICAL DISTRIBUTION EQUIPMENT.
9. GATE GROUNDING LOCATION
10. PROPOSED MOTORIZED VEHICLE SLIDE GATE.
11. PROPOSED RVSS SITE.
12. CONCEPTUAL ELECTRICAL UTILITY CONNECTION POINT.
13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

DESIGNED BY: X
DRAWN BY: X
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SIZE: ANSI D
ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

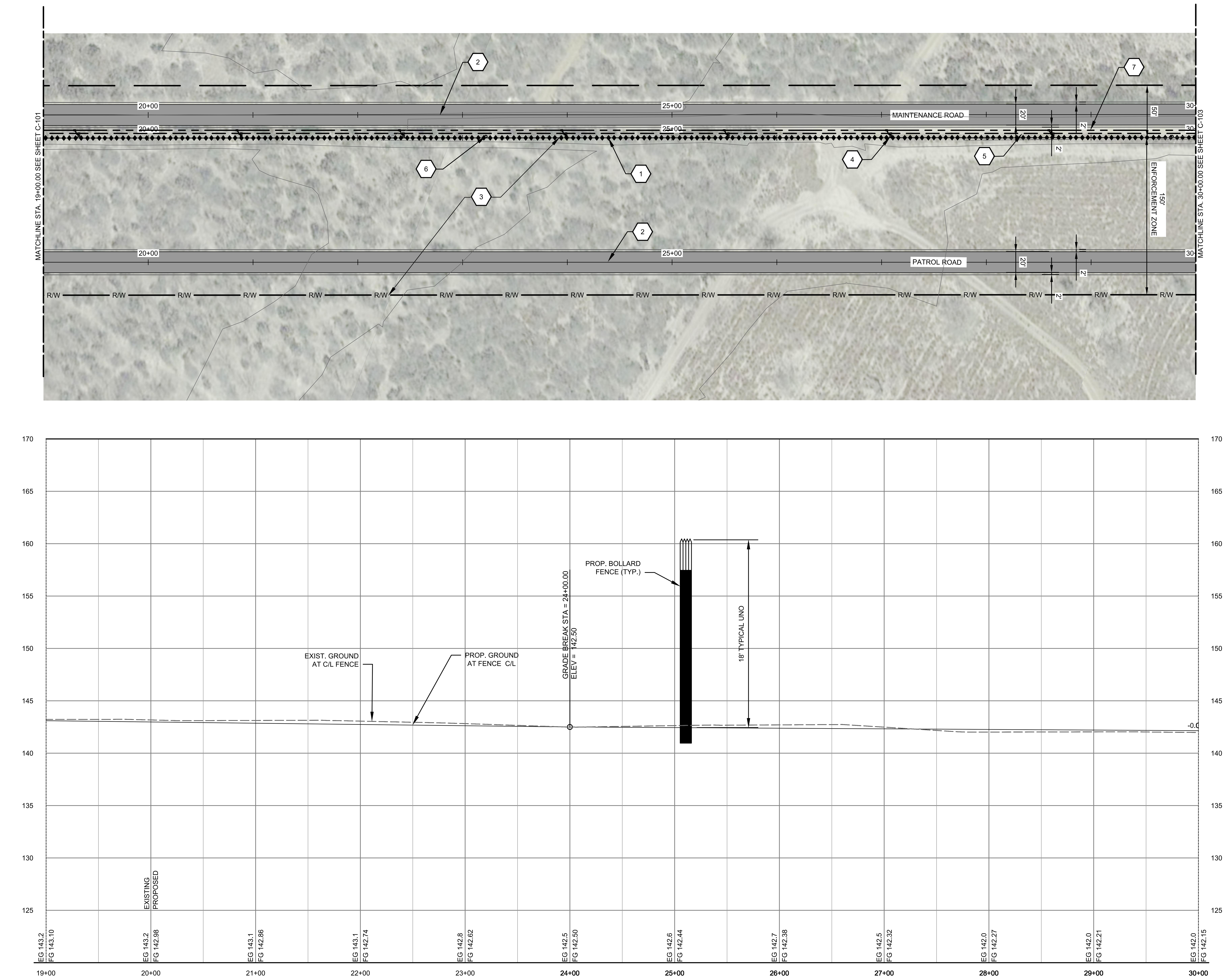
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 10+00.00 - 19+00.00

SHEET ID
LAGRULLA
C-101



A1 PLAN AND PROFILE
SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

0 50 100 1" = 50' - 0"   0 5 10 1' = 5' - 0"

GENERAL NOTES

1. THIS SHEET IS AT 35% CONCEPT DESIGN AND NOT TO BE USED FOR CONSTRUCTION.
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3. CONTRACTOR SHALL ENSURE THAT ALL DESIGNS MEET TACTICAL INFRASTRUCTURE STANDARDS, LATEST EDITION.
4. CONTRACTOR SHALL VERIFY LOCATION OF ALL UTILITIES, IRRIGATION CULVERTS AND DRAINAGE STRUCTURES, AND ADJUST/RELOCATE AS REQUIRED TO DE-CONFLICT WITH THE PROPOSED BOLLARD FENCE AND ENFORCEMENT ZONE (I.E.: EX. IRRIGATION VALVES TO BE RELOCATED TO NORTH LEVEE EMBANKMENT).
5. CONTRACTOR SHALL DESIGN AND INSTALL ALL DRAINAGE SYSTEMS FOR THIS PROJECT.
6. LIGHTING LOCATIONS ARE CONCEPTUAL. CONTRACTOR TO PROVIDE FINAL LIGHTING COMPUTATIONS AND LOCATIONS.

XX KEYNOTES

1. PROPOSED NEW TYPE P-3 BOLLARD FENCE.
2. PROPOSED TYPE FC-2 AGGREGATE ALL-WEATHER ROAD.
3. CLEAR VEGETATION AND GRADE WITHIN ENFORCEMENT ZONE.
4. PROPOSED LIGHT POLE, PULLBOX, AND LIGHTING - SEE ELEC. FOR LOCATIONS (TYP).
5. PROPOSED POWER AND LIGHTING DISTRIBUTION CABLE AND CONDUIT/ DUCT BANK.
6. PROPOSED FENCE GROUNDING LOCATION.
7. PROPOSED COMMUNICATION CONDUIT/ DUCTBANK. (CABLE FUTURE BY OTHERS)
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11. PROPOSED RVSS SITE.
12. CONCEPTUAL ELECTRICAL UTILITY CONNECTION POINT.
13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

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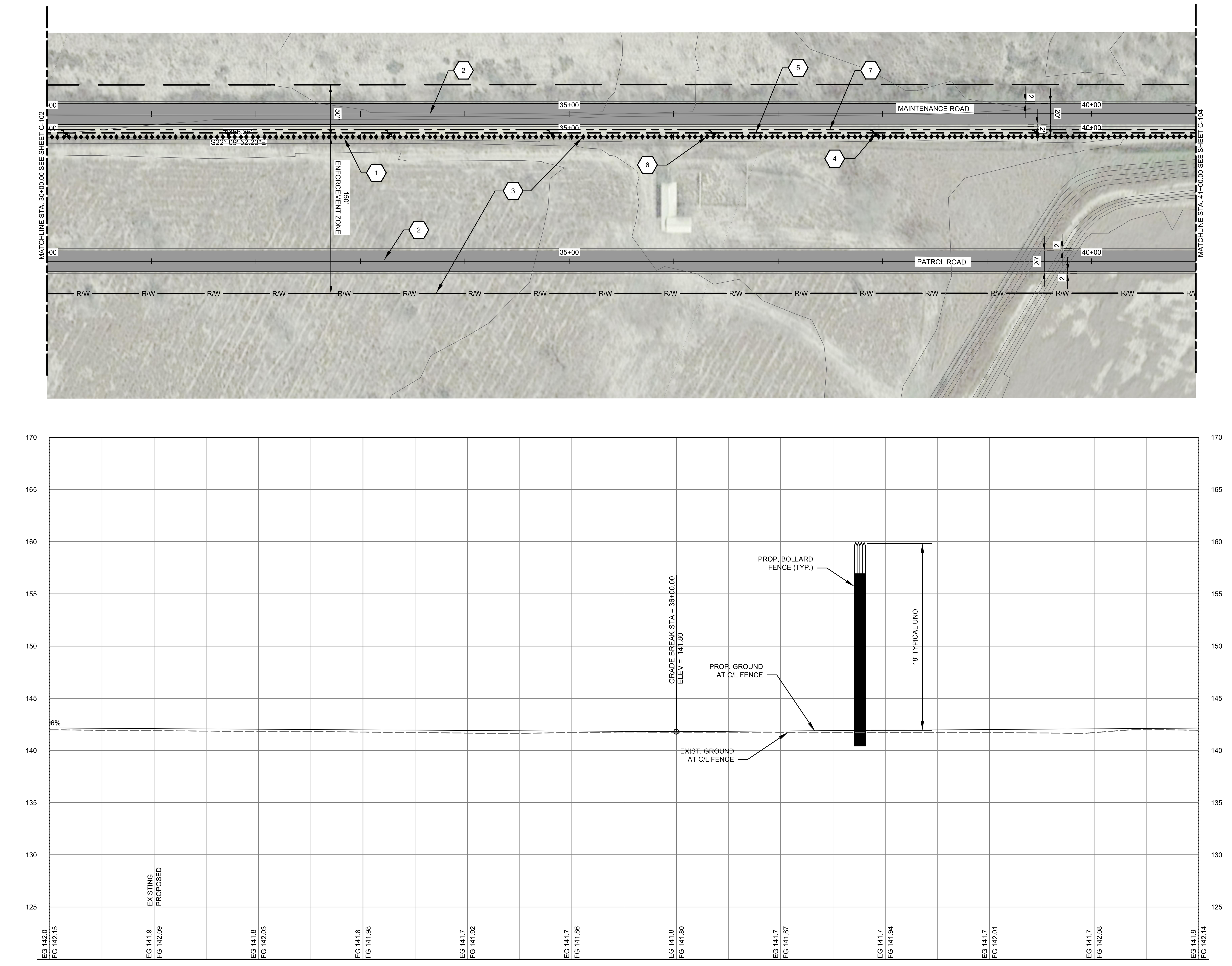
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 19+00.00 - 30+00.00

SHEET ID
LAGRULLA
C-102



A1 PLAN AND PROFILE
SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

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XX KEYNOTES

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2. PROPOSED TYPE FC-2 AGGREGATE ALL-WEATHER ROAD.
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US Army Corps of Engineers ®

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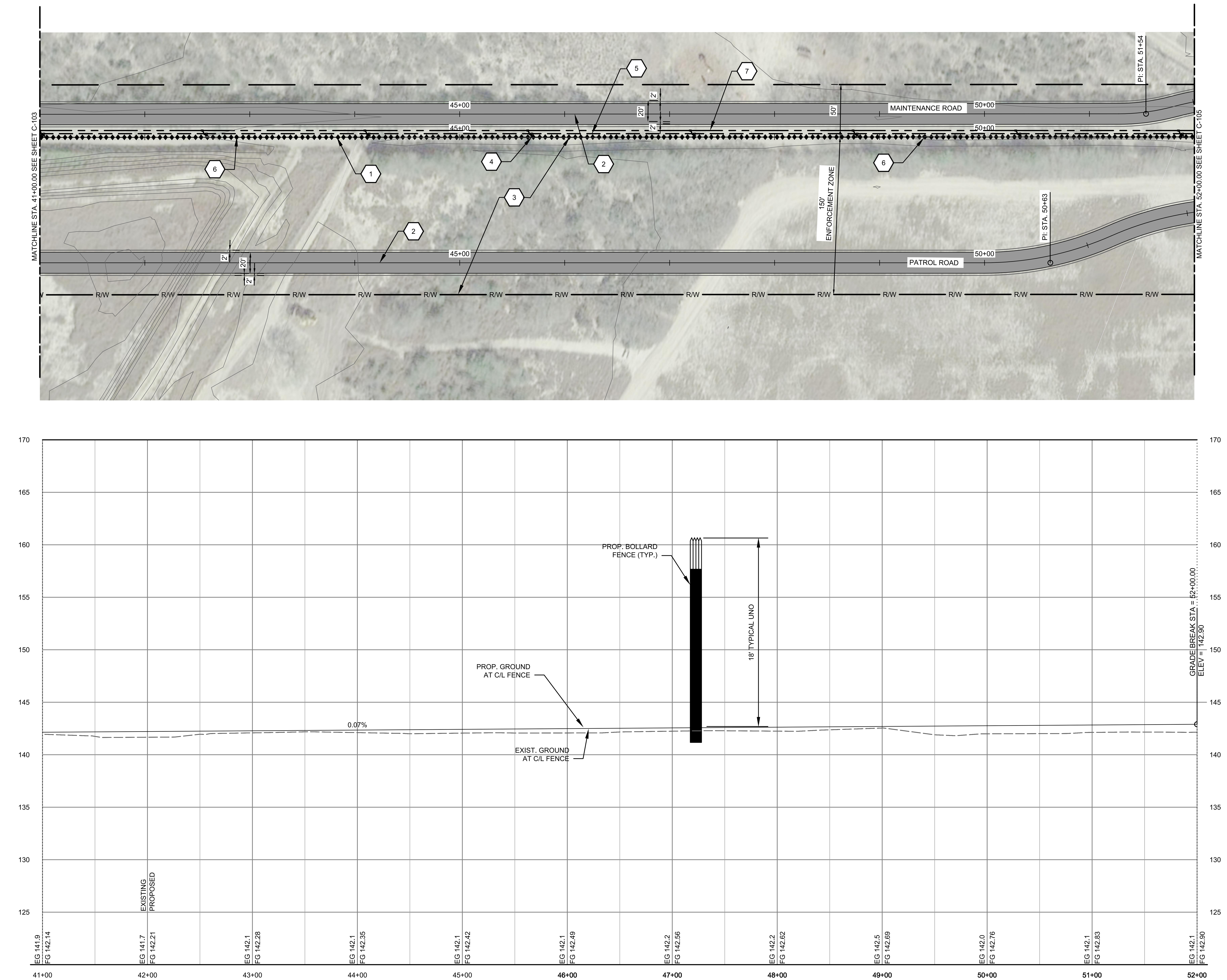
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 30+00.00 - 41+00.00

SHEET ID
LAGRULLA
C-103



A1 PLAN AND PROFILE
SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

1' = 50' - 0"
1' = 5' - 0"

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13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

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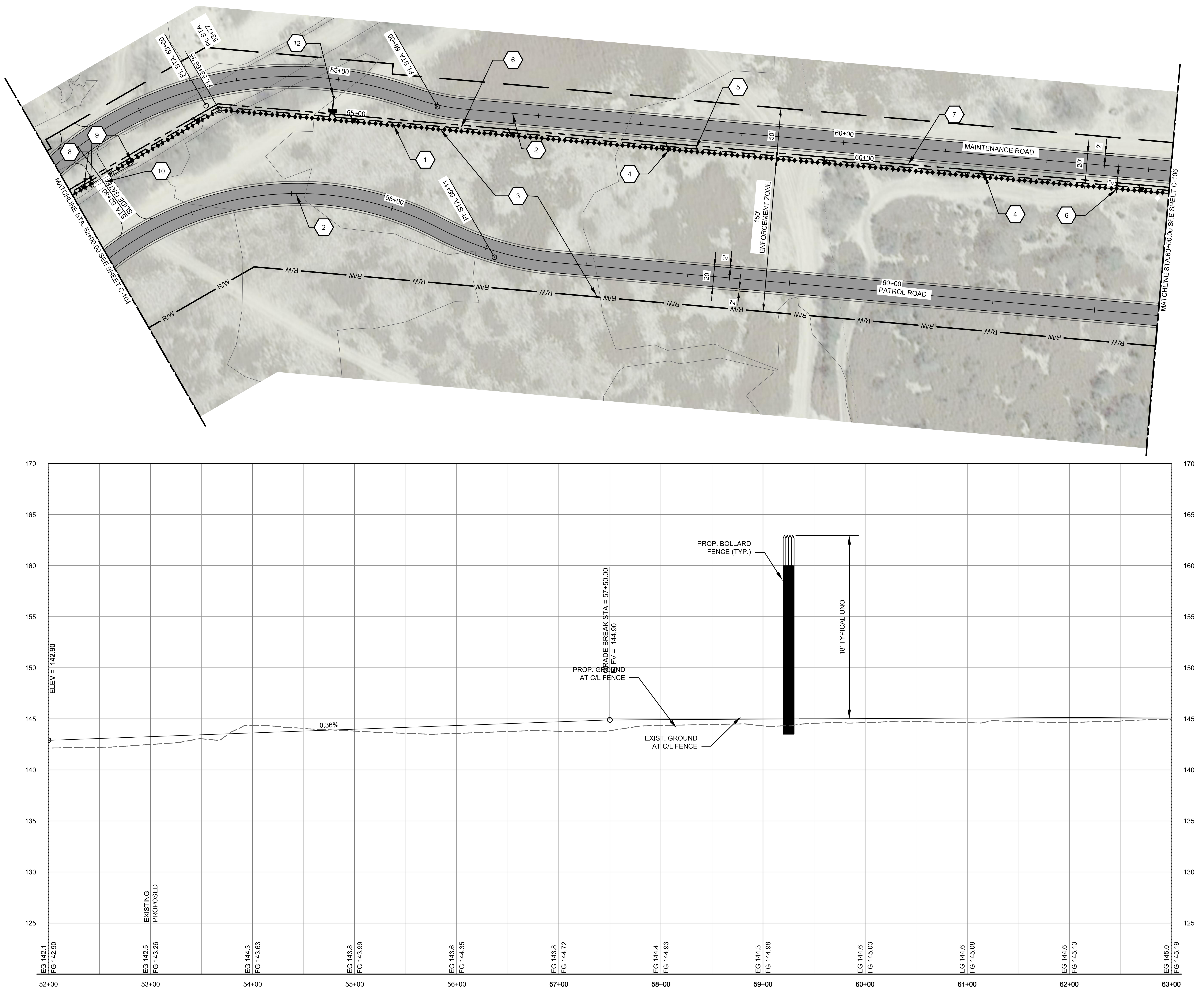
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 41+00.00 - 52+00.00

SHEET ID
LAGRULLA
C-104



A1 PLAN AND PROFILE
SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

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13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

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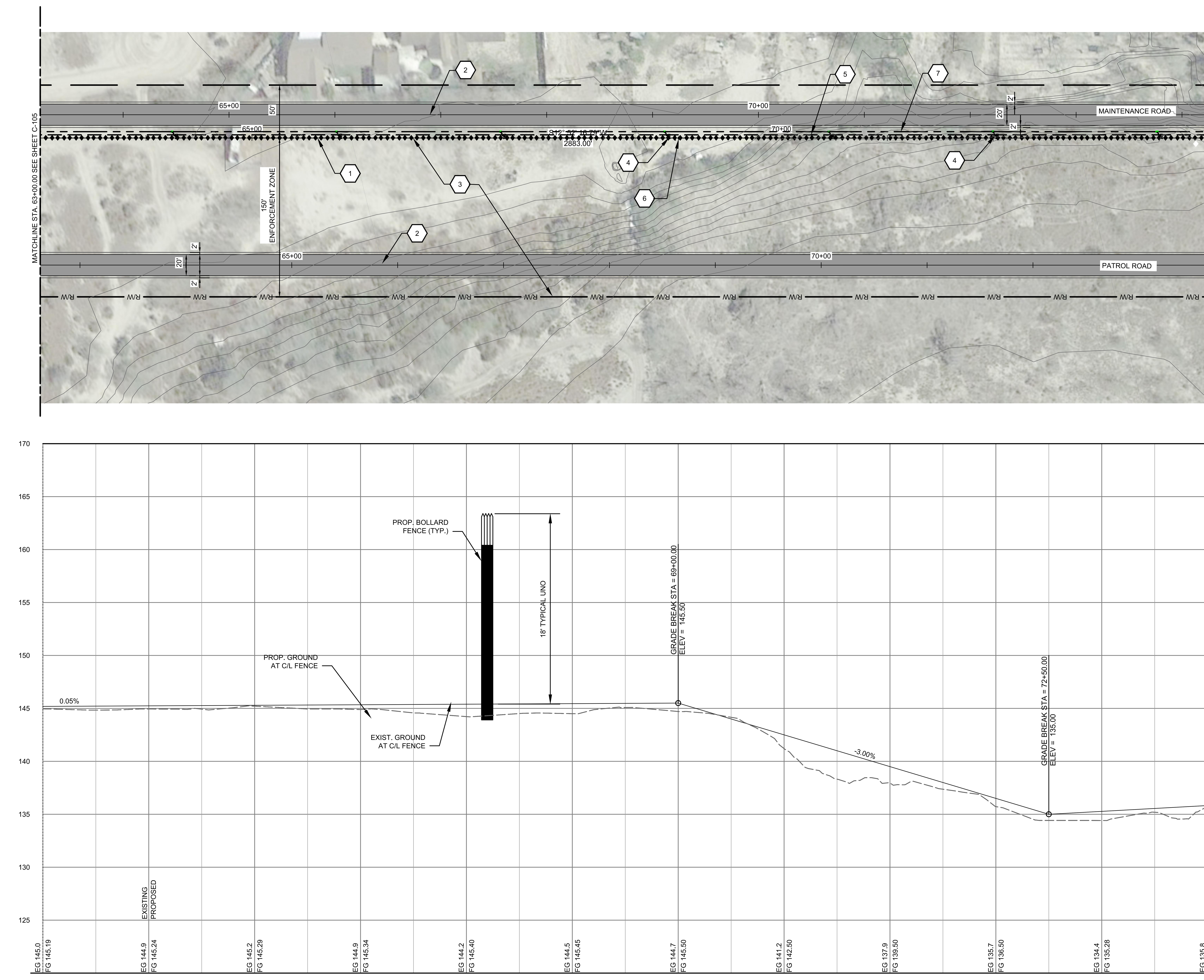
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE
PLAN AND PROFILE
STA. 52+00.00 - 63+00.00

SHEET ID
LAGRULLA
C-105



A1 PLAN AND PROFILE
SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

0 50 100 1" = 50' - 0"
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6. LIGHTING LOCATIONS ARE CONCEPTUAL. CONTRACTOR TO PROVIDE FINAL LIGHTING COMPUTATIONS AND LOCATIONS.

XX KEYNOTES

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13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

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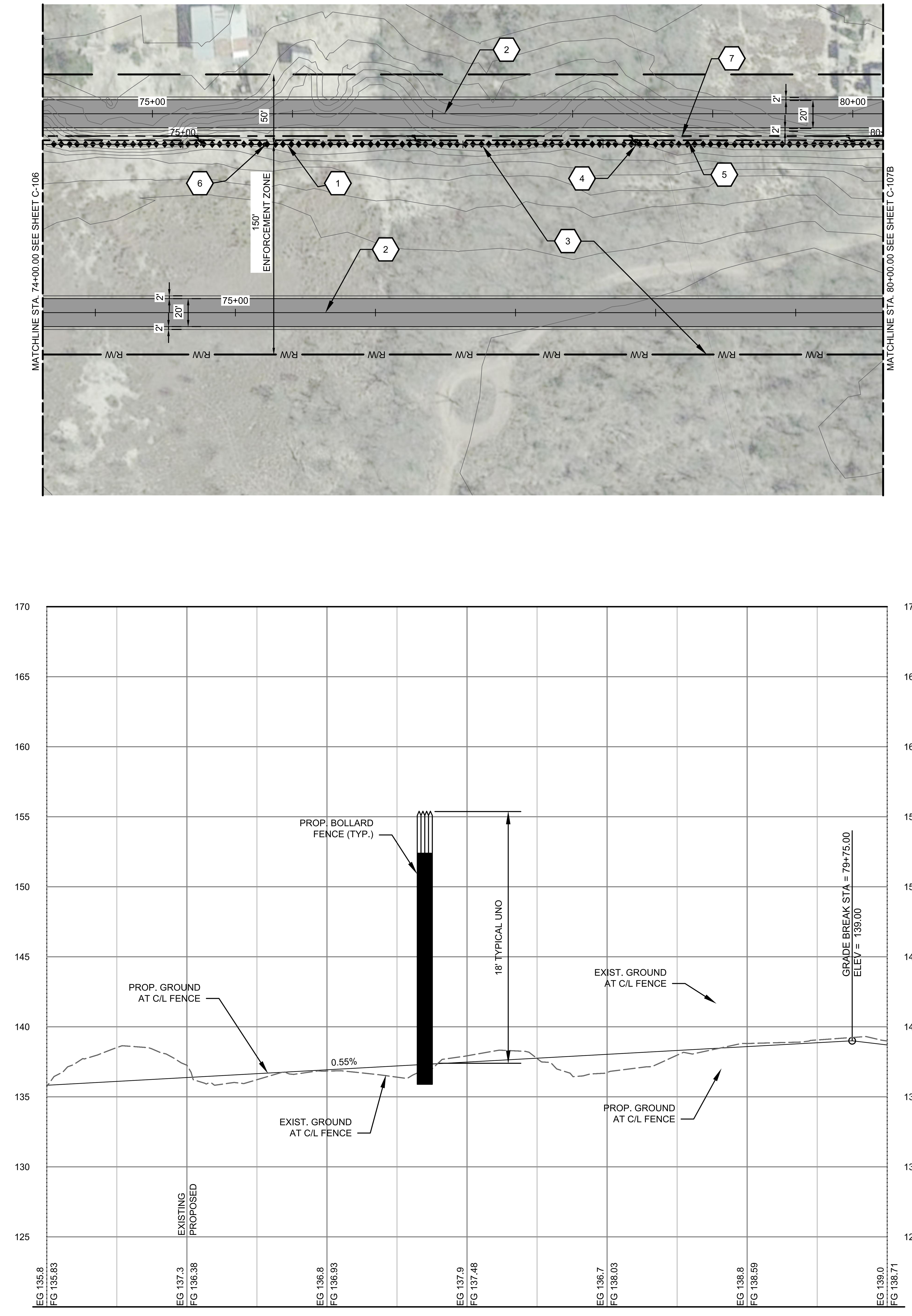
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 63+00.00 - 74+00.00

SHEET ID
LAGRULLA
C-106



A1 PLAN AND PROFILE
SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

1' = 50' - 0" 1' = 5' - 0"

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XX KEYNOTES

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13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

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US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 74+00.00 - 80+00.00

SHEET ID
LAGRULLA
C-107A

GENERAL NOTES

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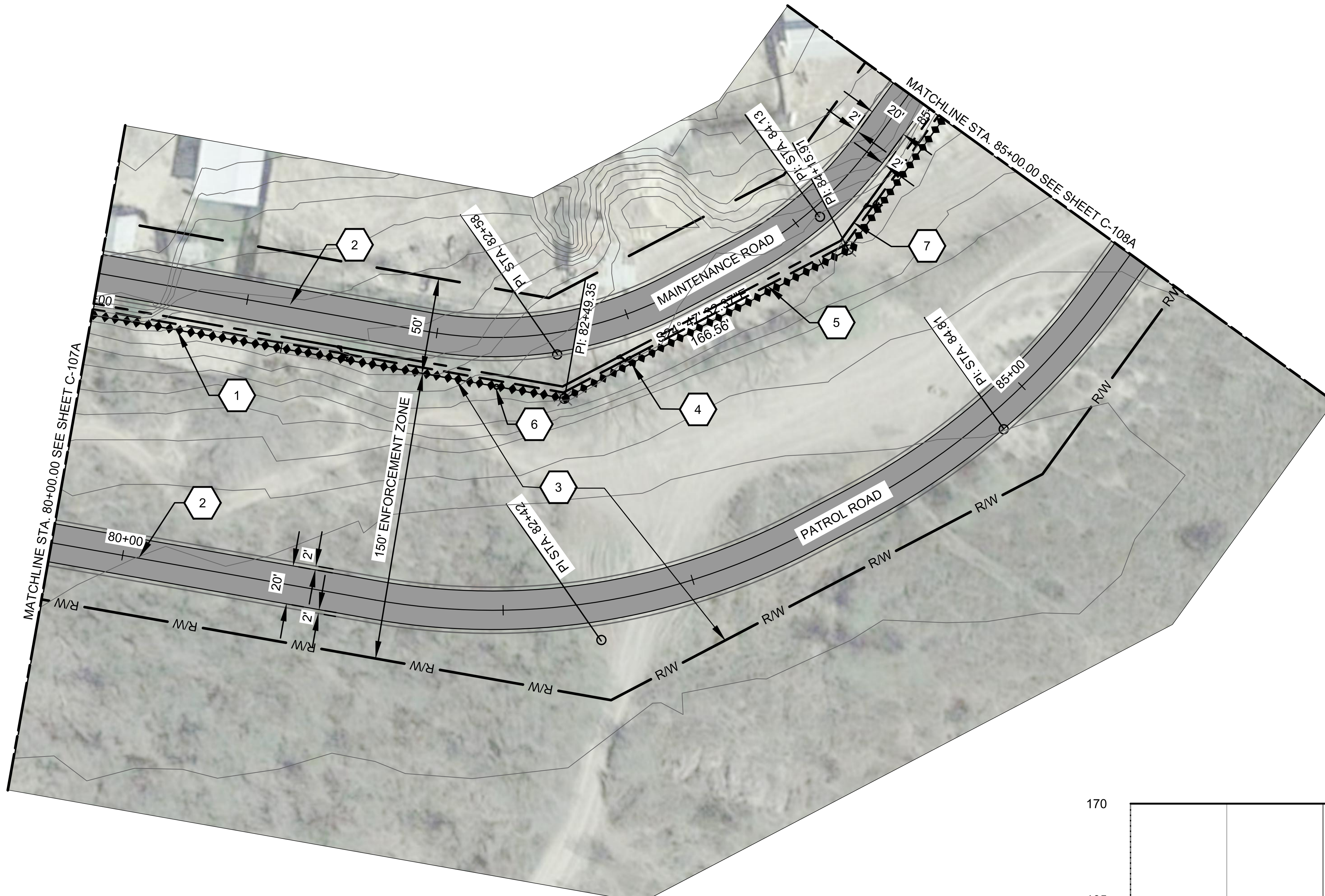

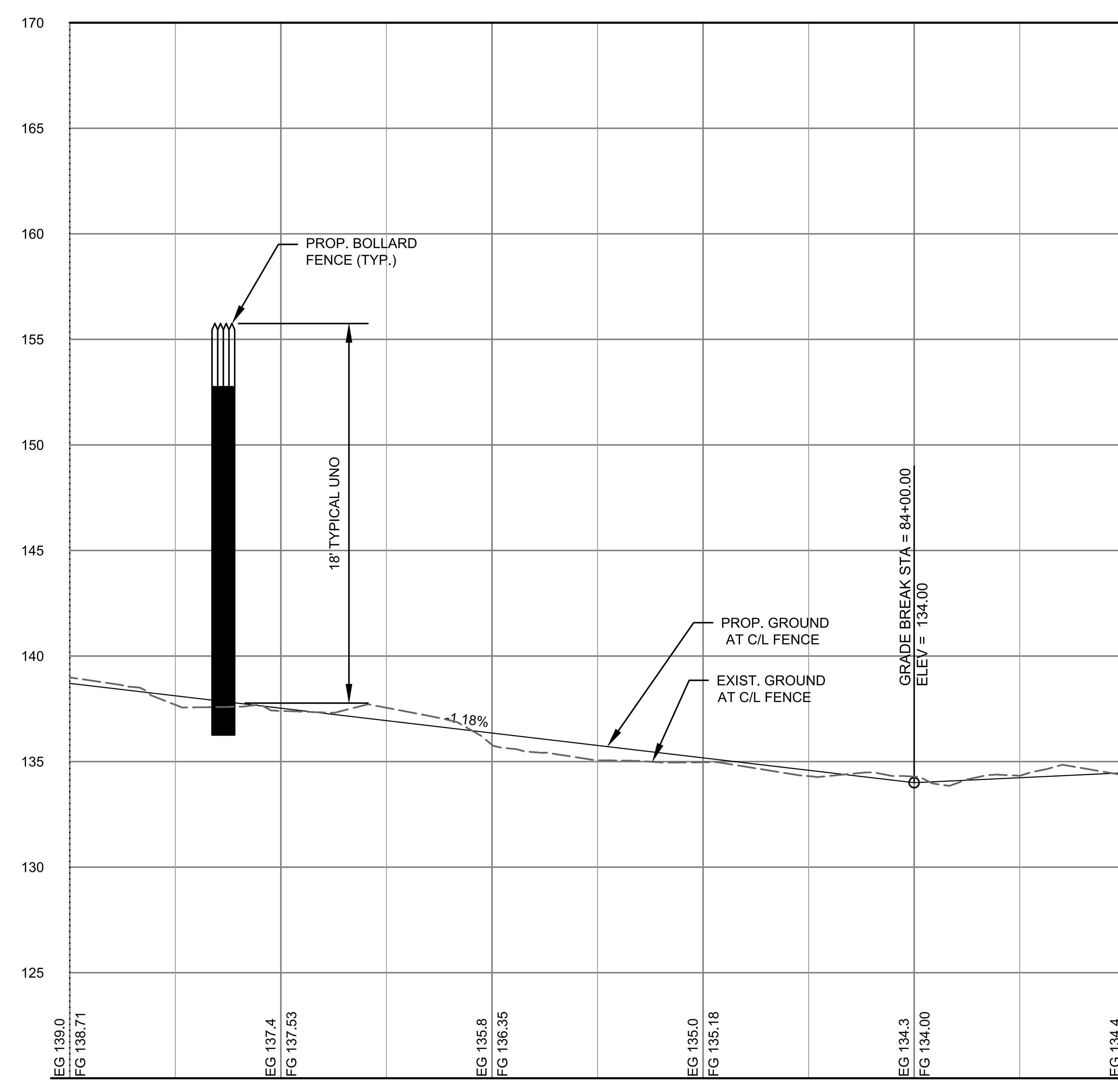

A1 PLAN AND PROFILE
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US Army Corps of Engineers ®

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US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
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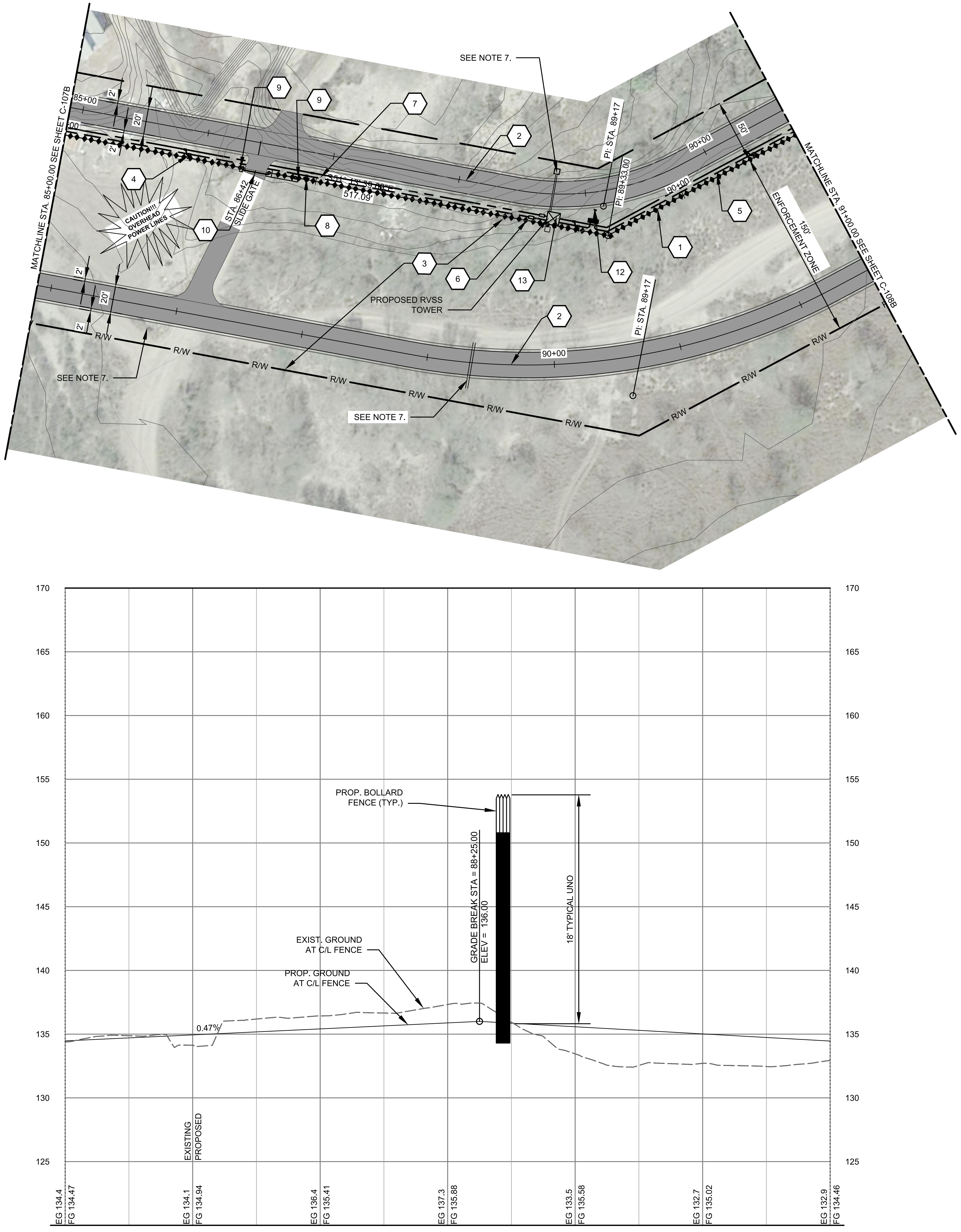
ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 80+00.00 - 85+00.00

SHEET ID
LAGRULLA
C-107B



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7. SEE SHEET E-502 FOR TYPICAL PLAN VIEW AT RVSS TOWER.

XX KEYNOTES

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6. PROPOSED FENCE GROUNDING LOCATION.
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8. GATE ELECTRICAL DISTRIBUTION EQUIPMENT.
9. GATE GROUNDING LOCATION
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11. PROPOSED RVSS SITE.
12. CONCEPTUAL ELECTRICAL UTILITY CONNECTION POINT.
13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

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SOLICITATION NO:
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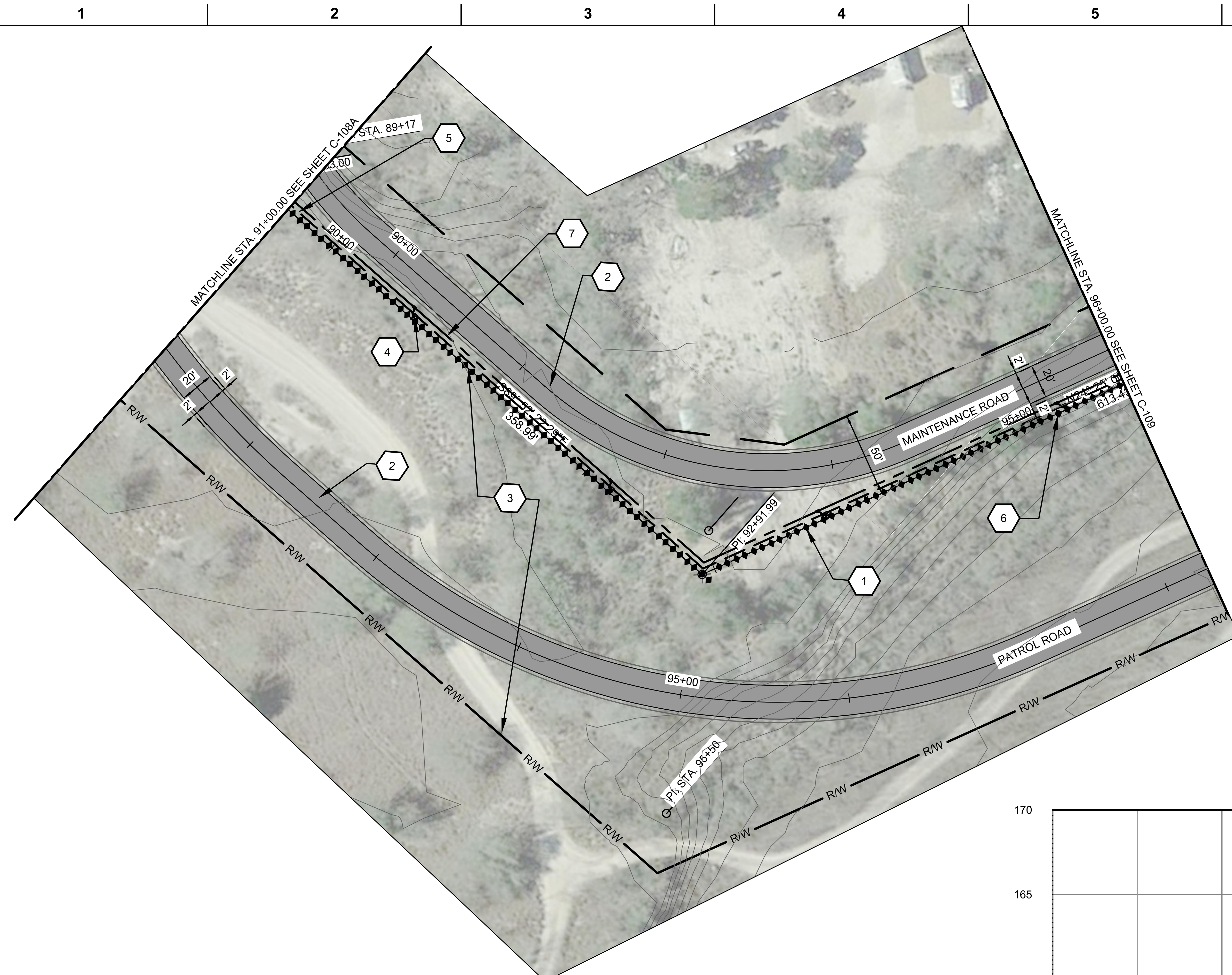
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

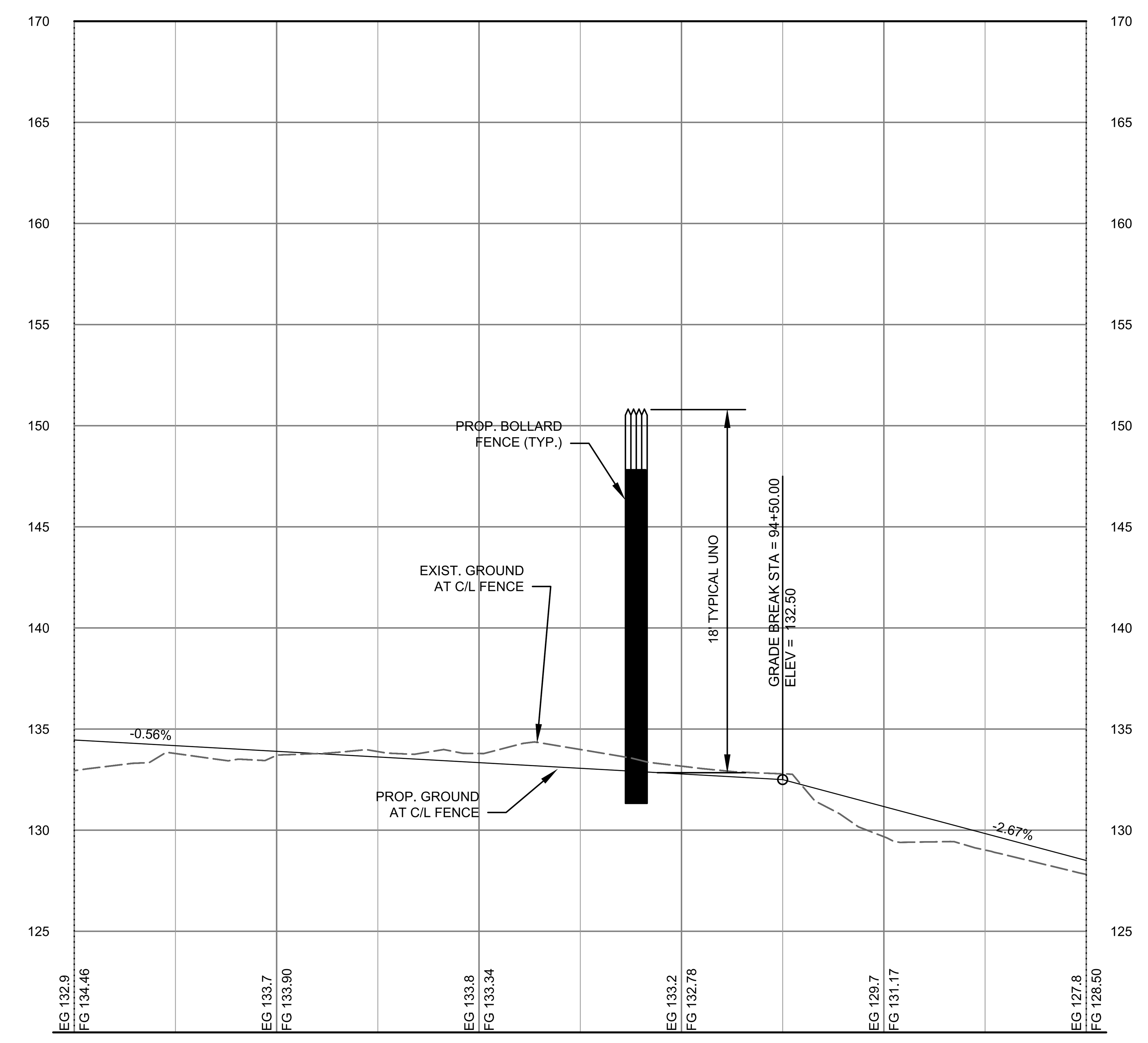
ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 85+00.00 - 91+00.00

SHEET ID
LAGRULLA
C-108A





A1 PLAN AND PROFILE
SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

0 50 100 1" = 50' - 0"
0 5 10 1' = 5' - 0"

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US Army Corps of Engineers ®

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ETEGRA
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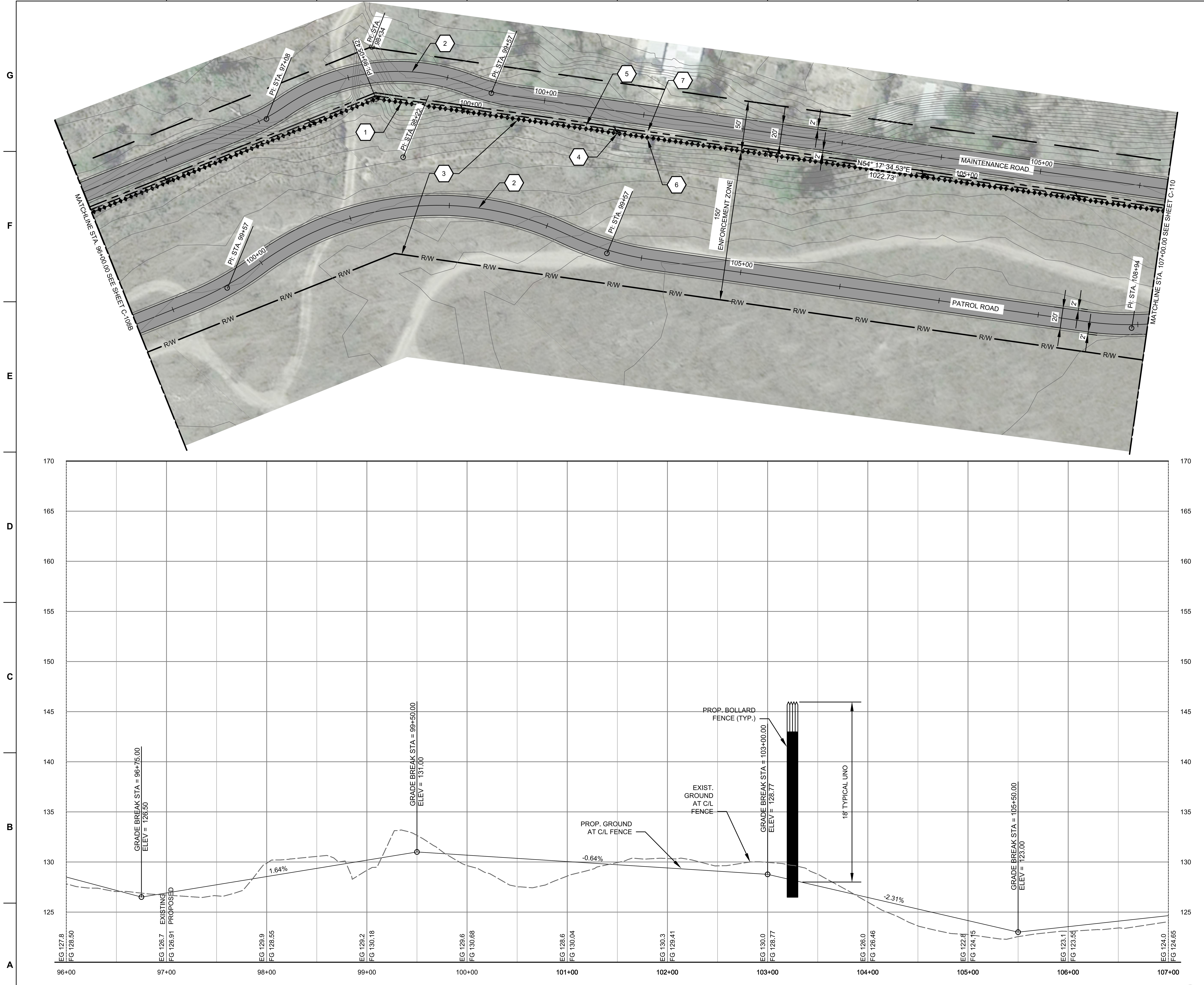
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 91+00.00 - 96+00.00

SHEET ID
LAGRULLA
C-108B



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US Army Corps of Engineers ®

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ETEGRA
17218 PRESTON RD., SUITE 3300
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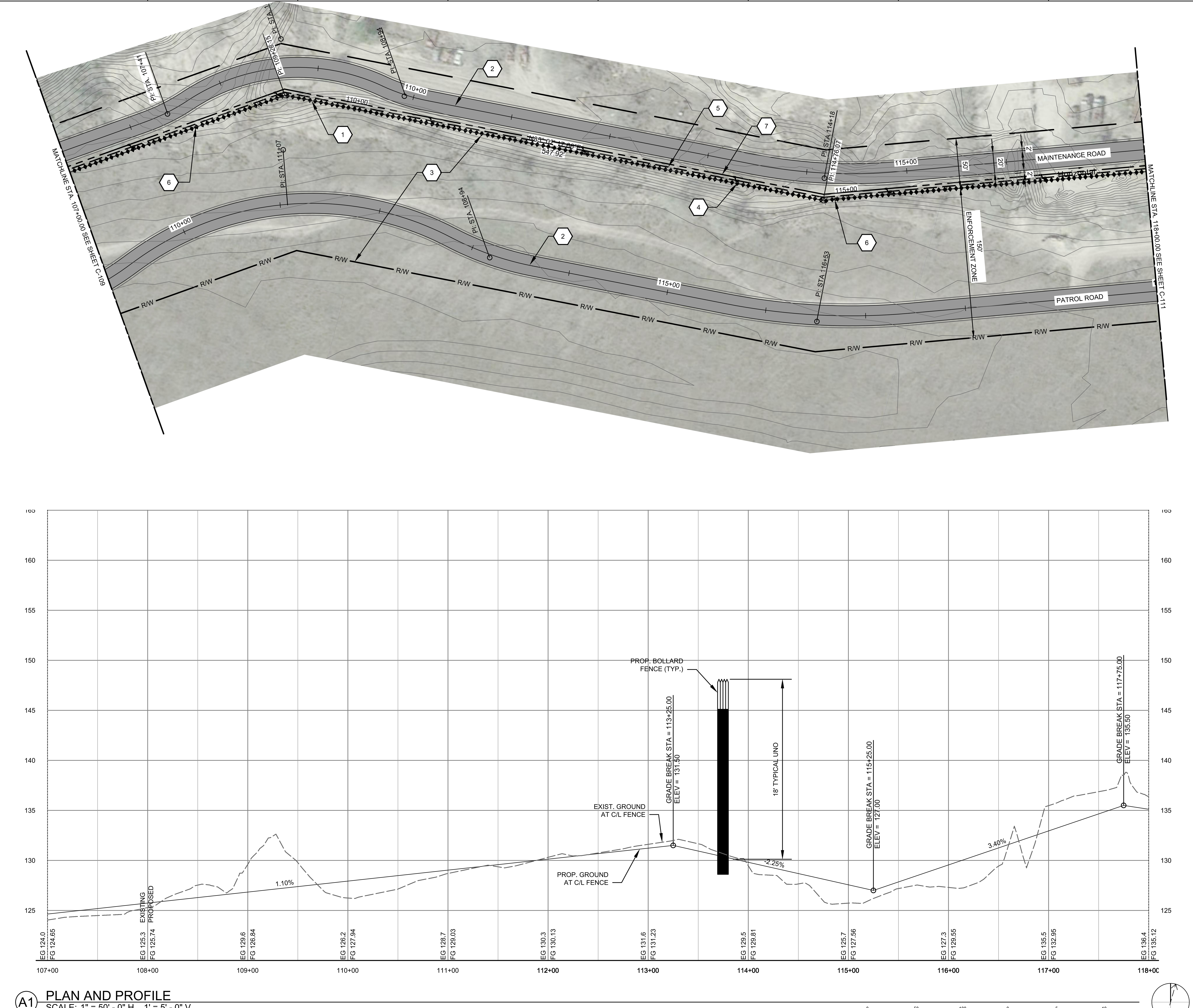
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 96+00.00 - 107+00.00

SHEET ID
LAGRULLA
C-109



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US Army Corps of Engineers ®

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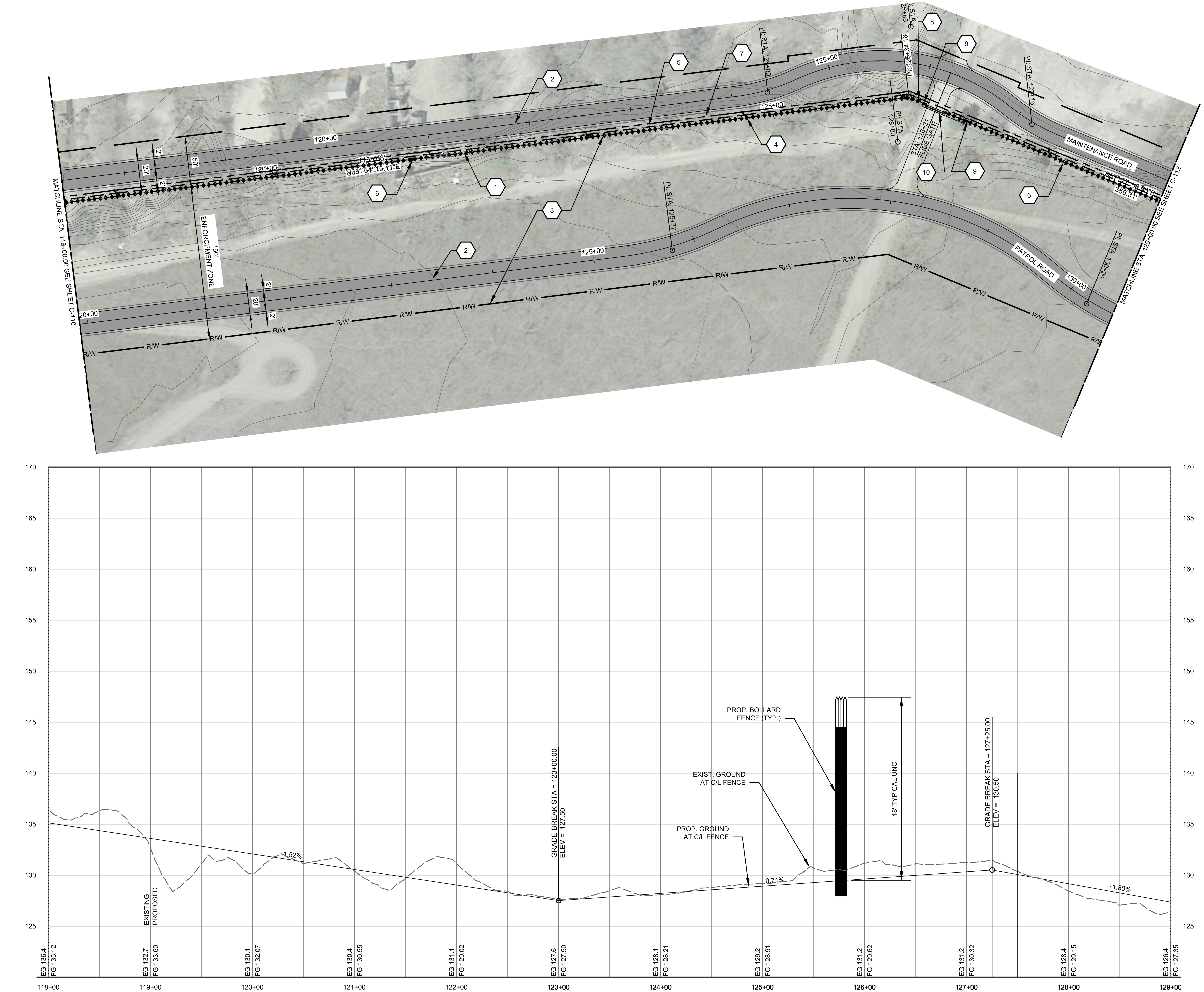
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 107+00.00 - 118+00.00

SHEET ID
LAGRULLA
C-110



A1 PLAN AND PROFILE
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US Army Corps of Engineers ®

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US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 118+00.00 - 129+00.00

SHEET ID
LAGRULLA
C-111

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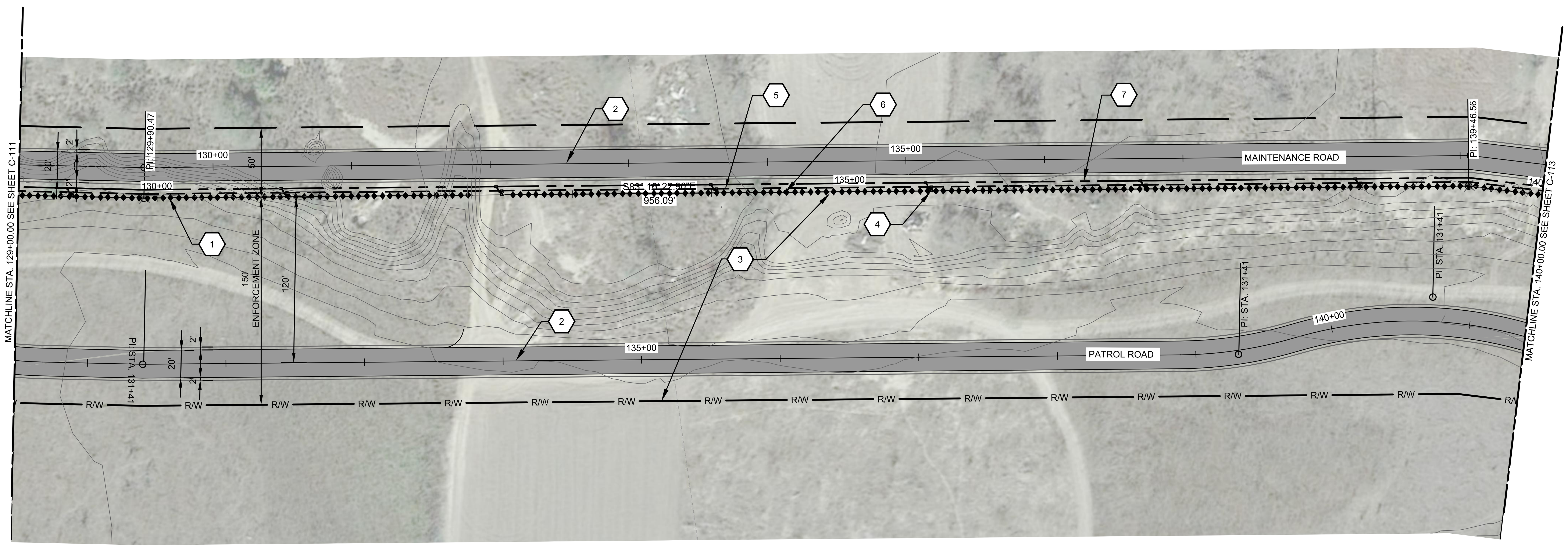

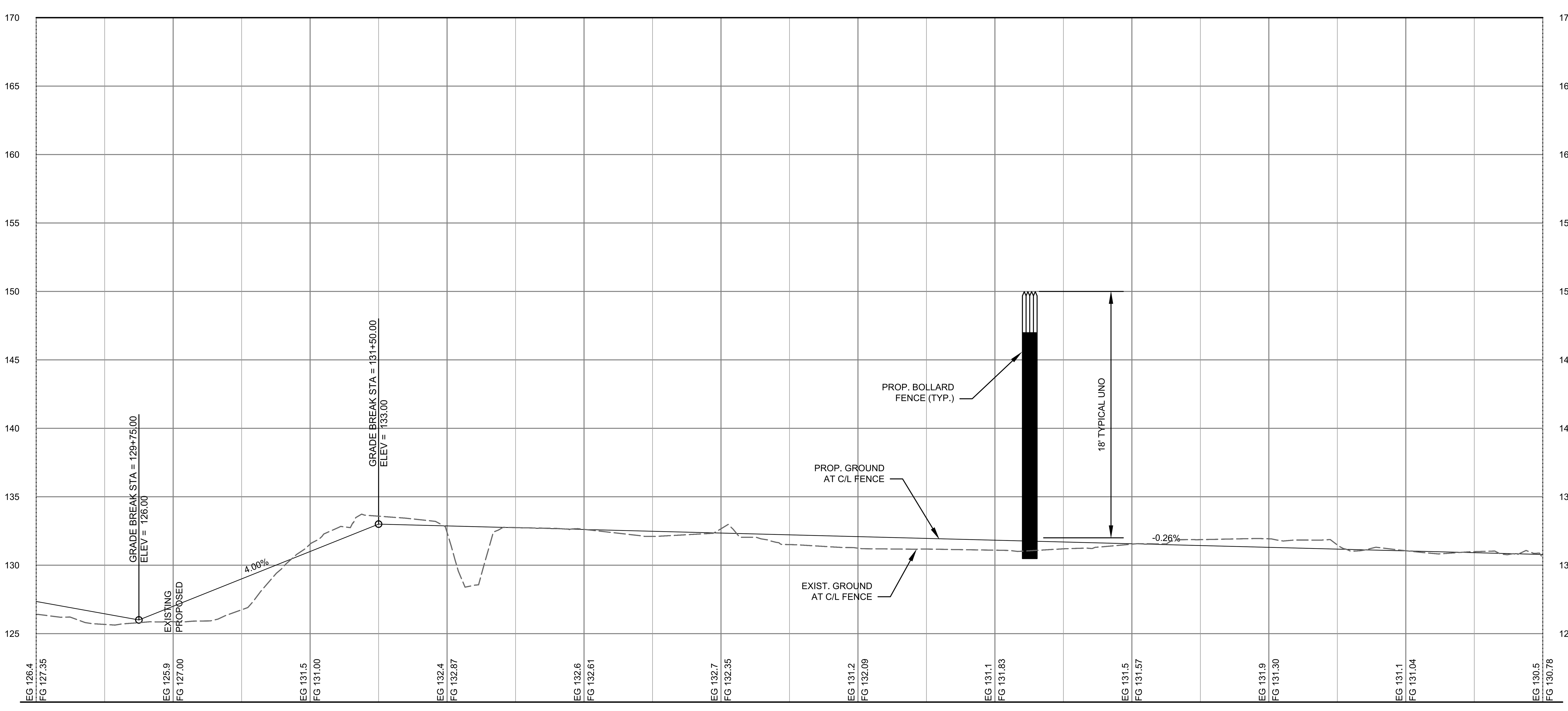

A1 PLAN AND PROFILE
SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

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US Army Corps of Engineers ®

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US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
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ETEGRA
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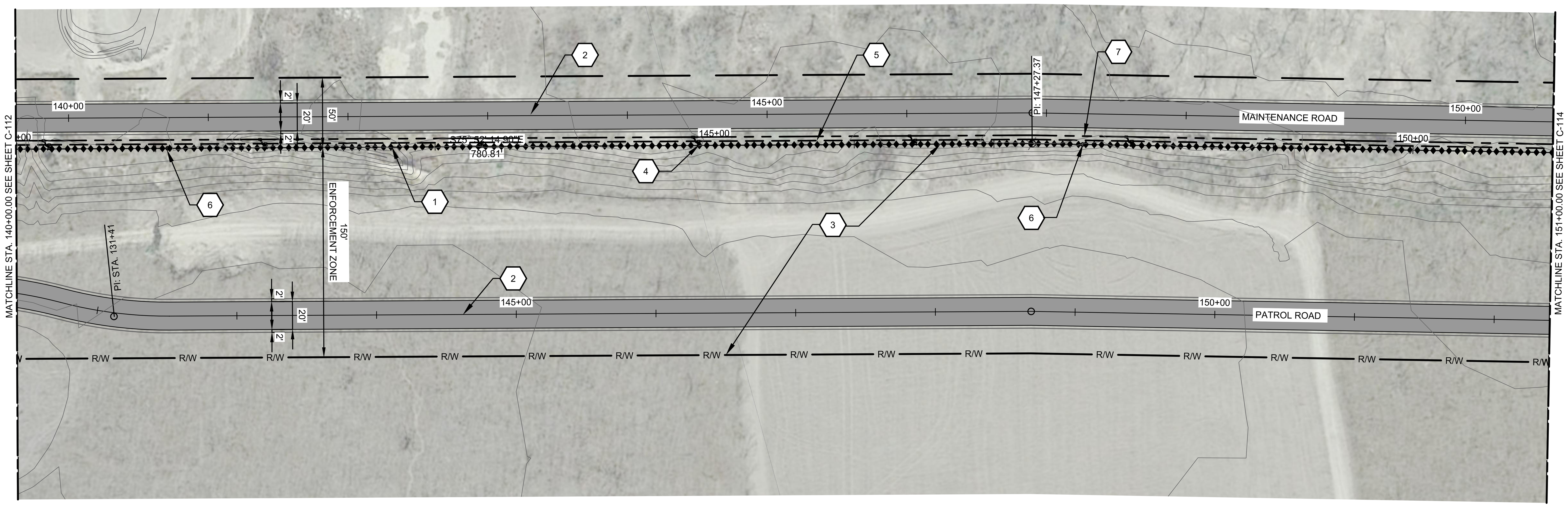
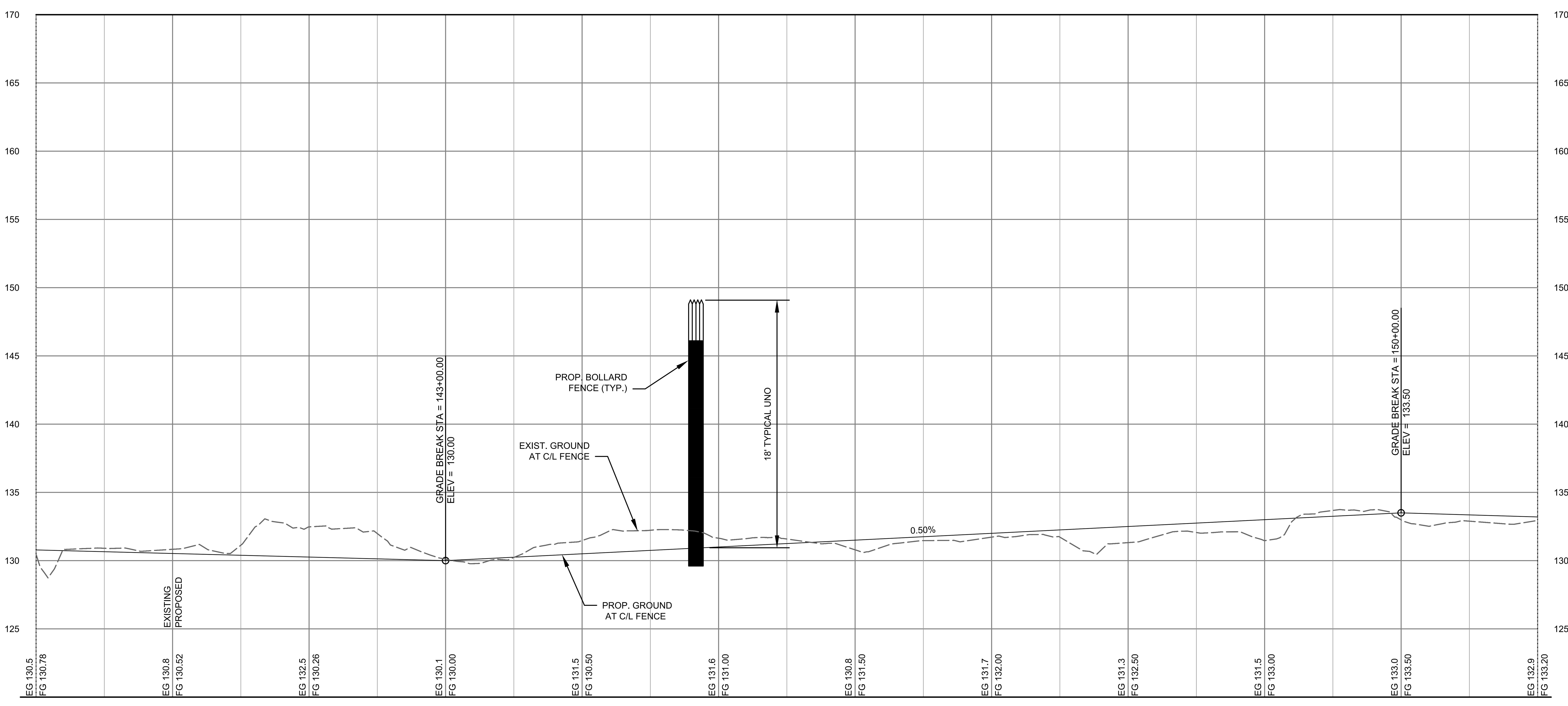
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 129+00.00 - 140+00.00

SHEET ID
LAGRULLA
C-112





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US Army Corps of Engineers ®

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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 140+00.00 - 151+00.00

SHEET ID
LAGRULLA
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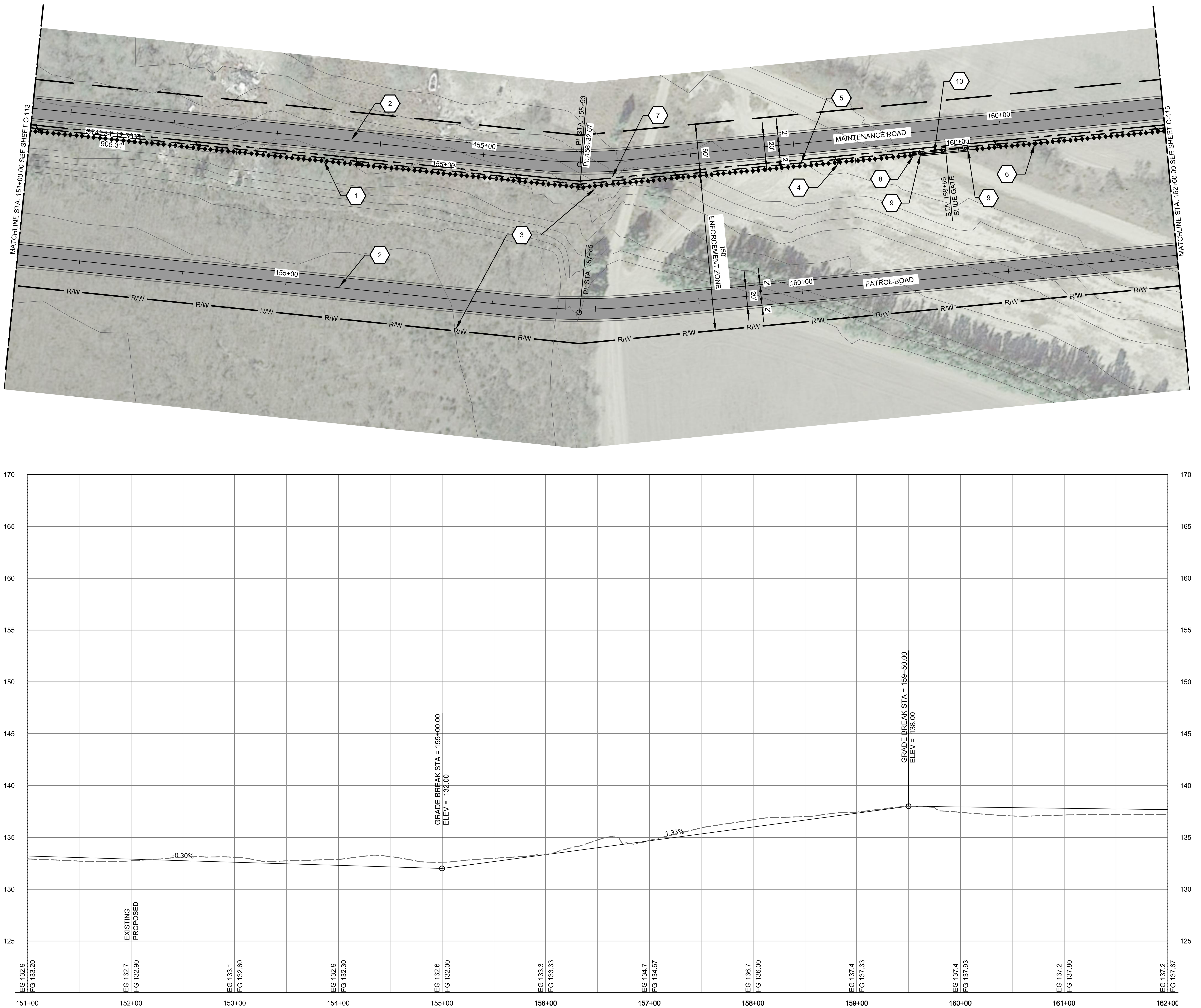

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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

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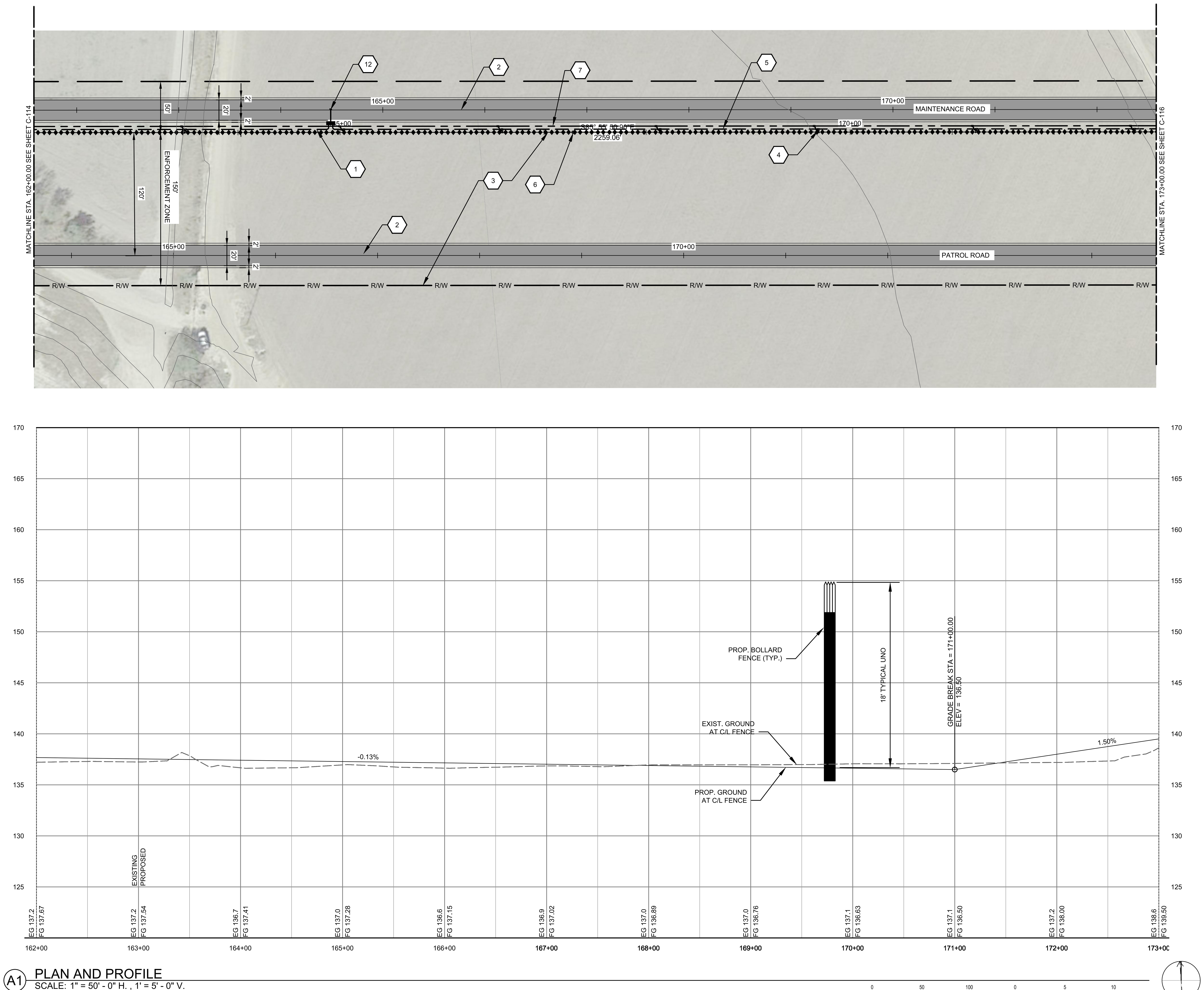

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5. CONTRACTOR SHALL DESIGN AND INSTALL ALL DRAINAGE SYSTEMS FOR THIS PROJECT.
6. LIGHTING LOCATIONS ARE CONCEPTUAL. CONTRACTOR TO PROVIDE FINAL LIGHTING COMPUTATIONS AND LOCATIONS.

XX KEYNOTES

1. PROPOSED NEW TYPE P-3 BOLLARD FENCE.
2. PROPOSED TYPE FC-2 AGGREGATE ALL-WEATHER ROAD.
3. CLEAR VEGETATION AND GRADE WITHIN ENFORCEMENT ZONE.
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8. GATE ELECTRICAL DISTRIBUTION EQUIPMENT.
9. GATE GROUNDING LOCATION
10. PROPOSED MOTORIZED VEHICLE SLIDE GATE.
11. PROPOSED RVSS SITE.
12. CONCEPTUAL ELECTRICAL UTILITY CONNECTION POINT.
13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

DESIGNED BY: X
DRAWN BY: X
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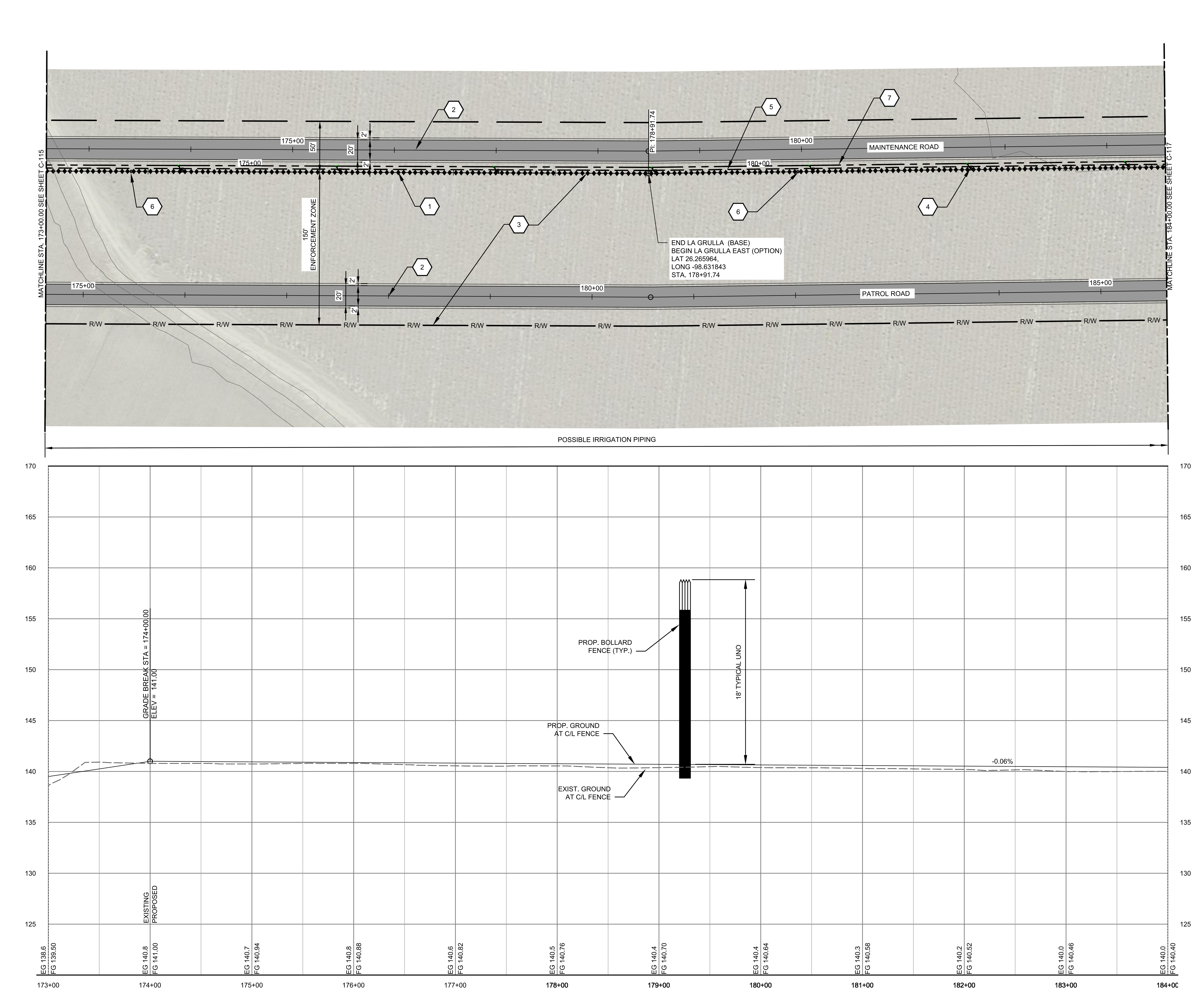
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 162+00.00 - 173+00.00

SHEET ID
LAGRULLA
C-115



A1 PLAN AND PROFILE
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13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

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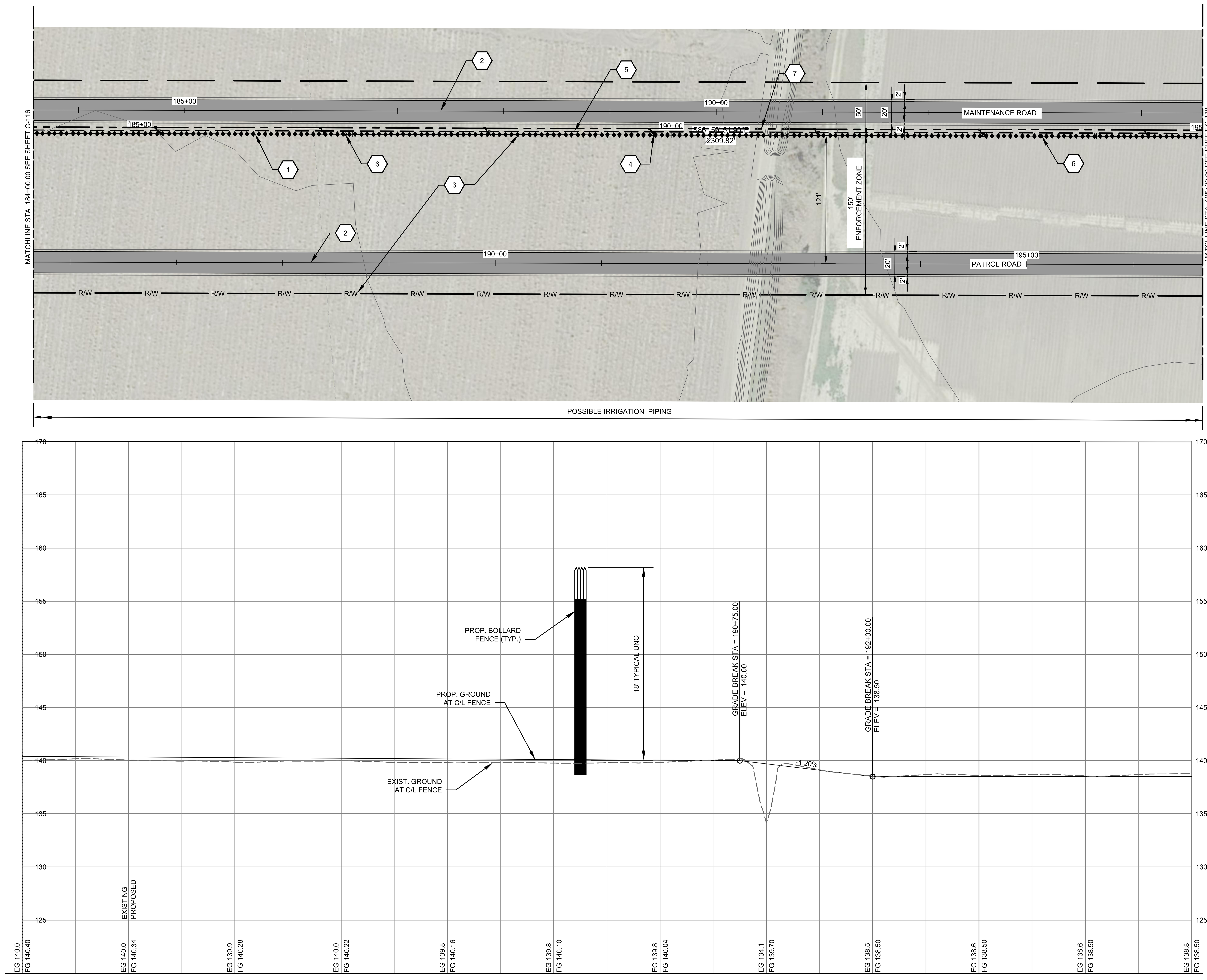
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 173+00.00 - 184+00.00

SHEET ID
LAGRULLA
C-116



A1 PLAN AND PROFILE
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US Army Corps of Engineers ®

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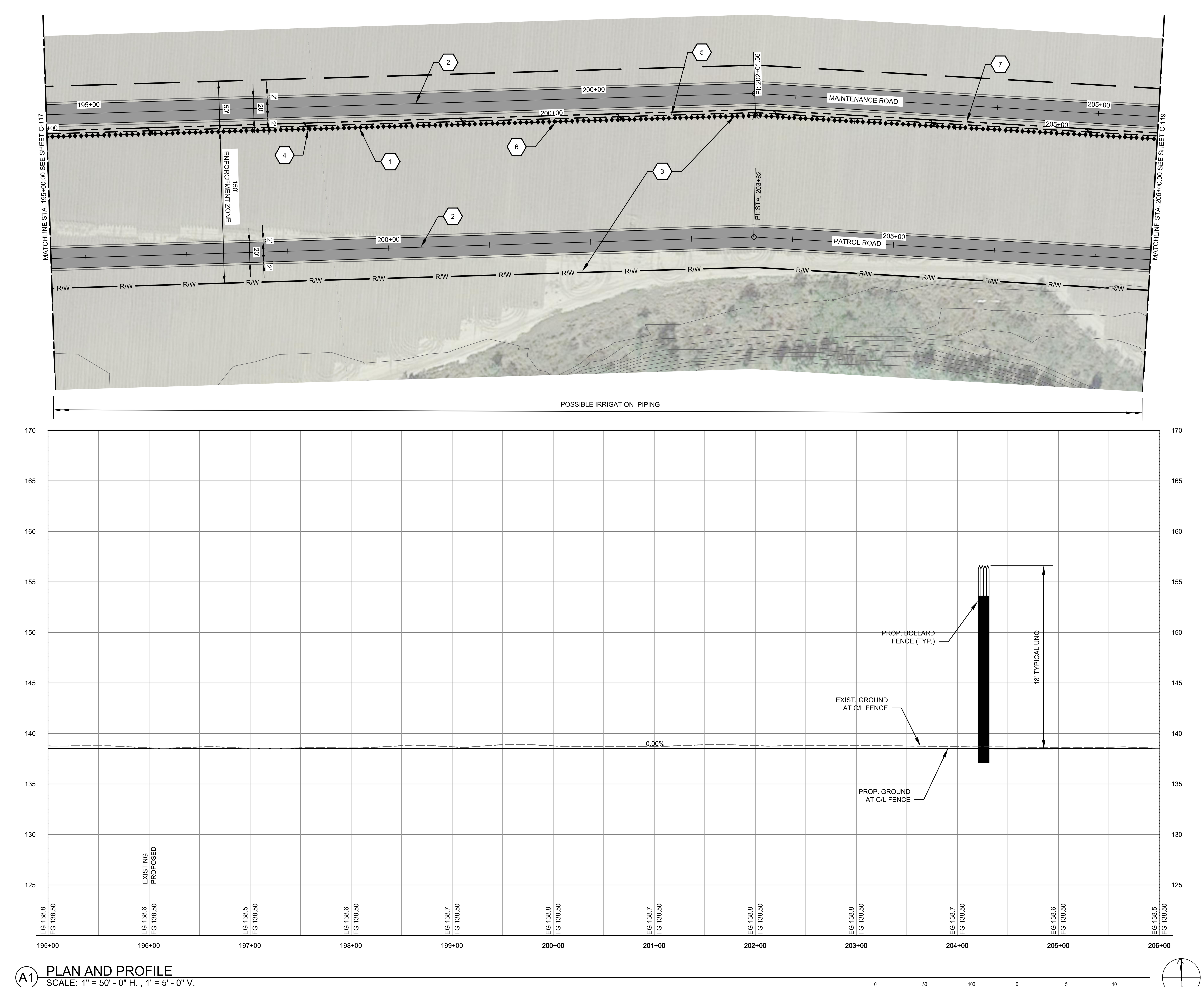
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 184+00.00 - 195+00.00

SHEET ID
LAGRULLA
C-117



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US Army Corps of Engineers ®

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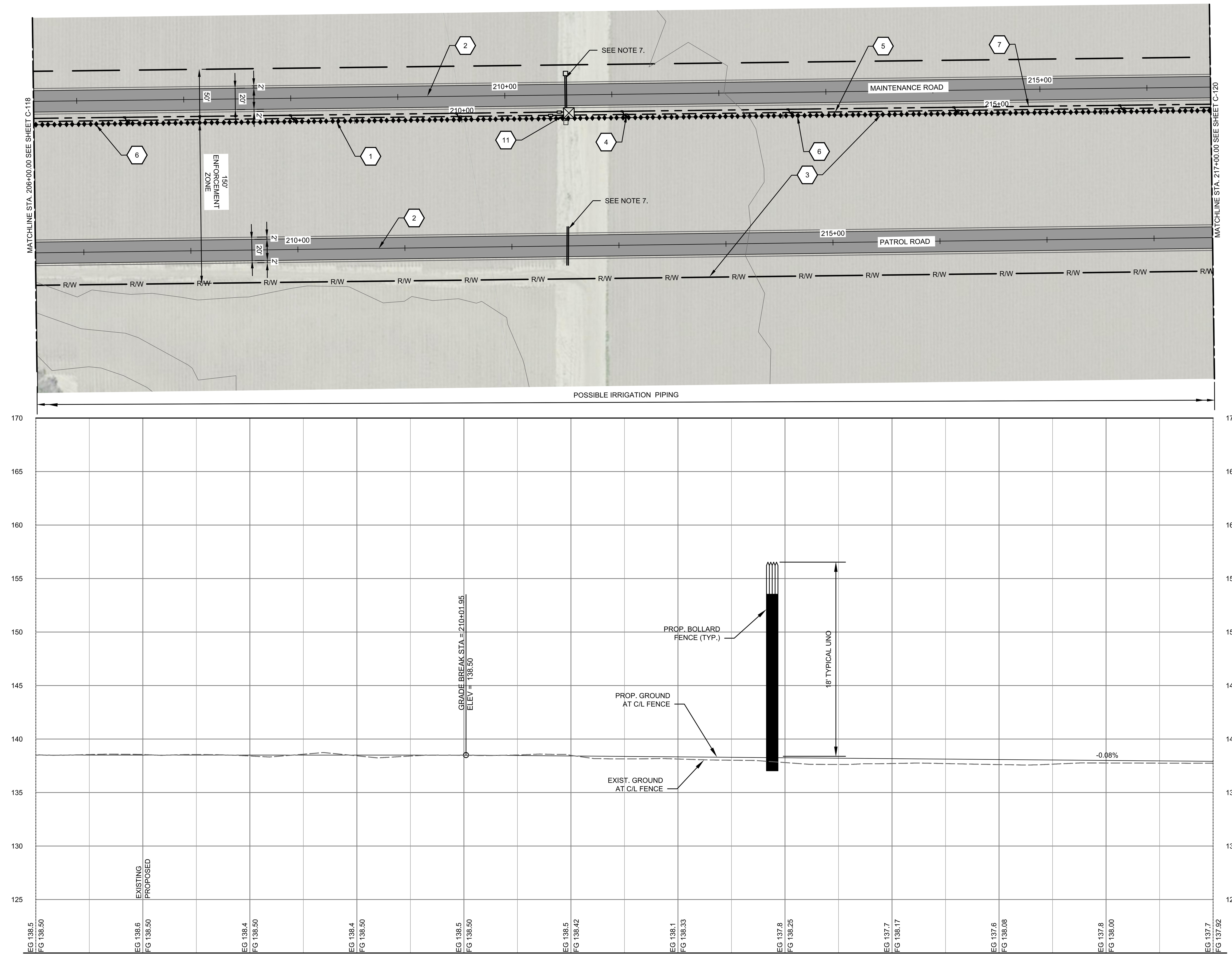
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 195+00.00 - 206+00.00

SHEET ID
LAGRULLA
C-118



A1 PLAN AND PROFILE
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7. SEE SHEET E-502 FOR TYPICAL PLAN VIEW AT RVSS TOWER.

XX KEYNOTES

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US Army Corps of Engineers ®

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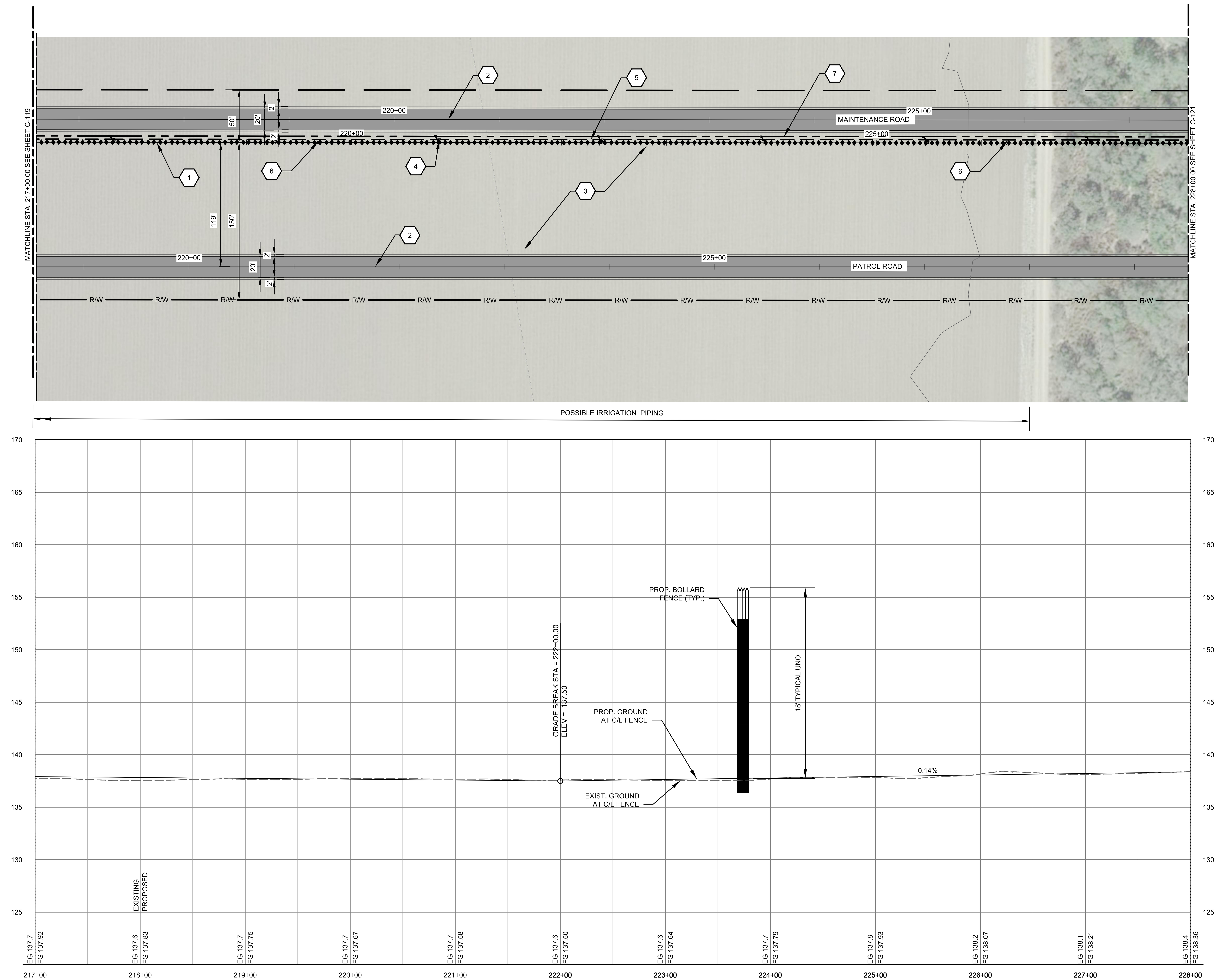
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 206+00.00 - 217+00.00

SHEET ID
LAGRULLA
C-119



A1 PLAN AND PROFILE
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0 50 100 1' = 50' - 0" 0 5 10 1' = 5' - 0"

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US Army Corps of Engineers ®

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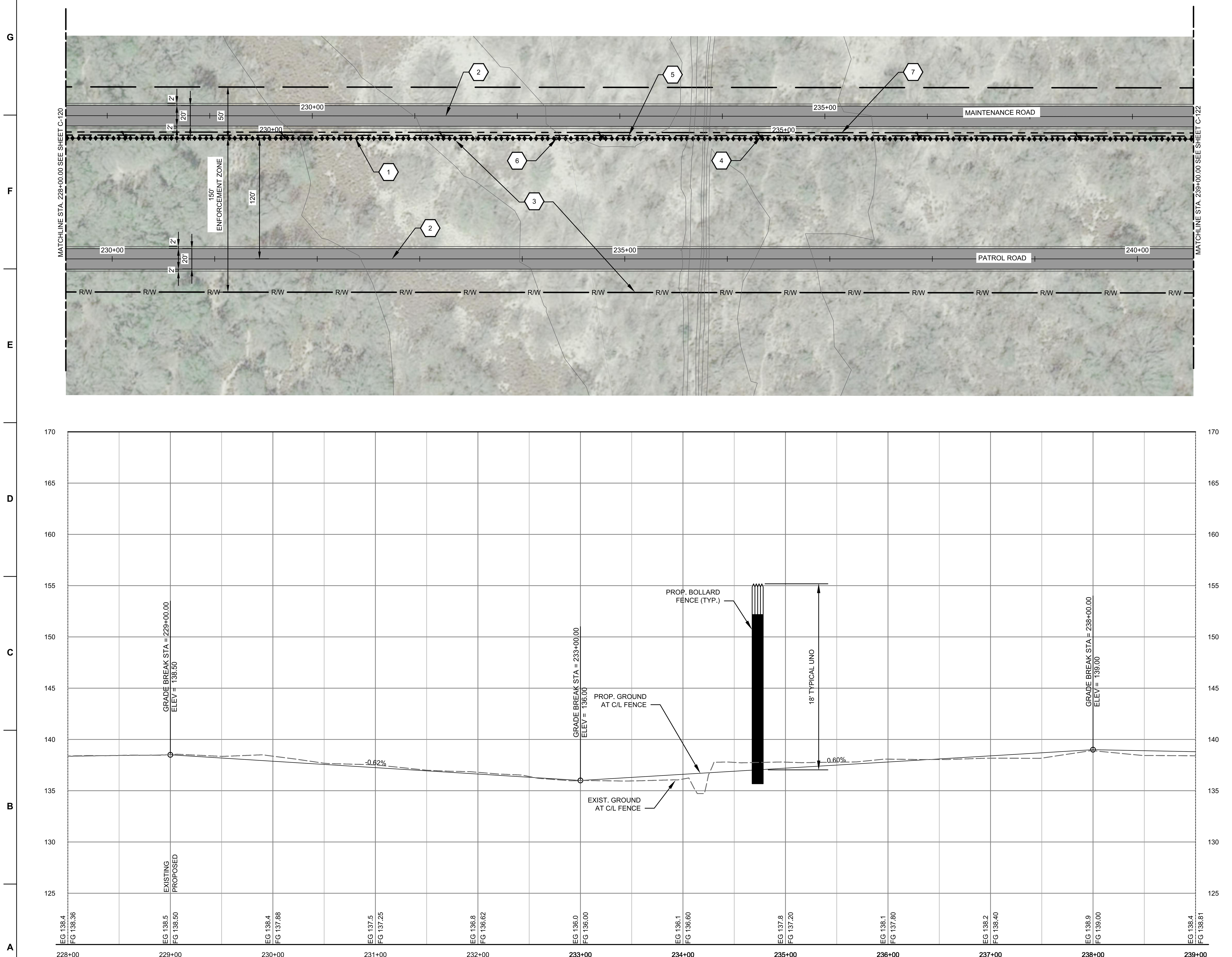
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 217+00.00 - 228+00.00

SHEET ID
LAGRULLA
C-120



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US Army Corps of Engineers ®

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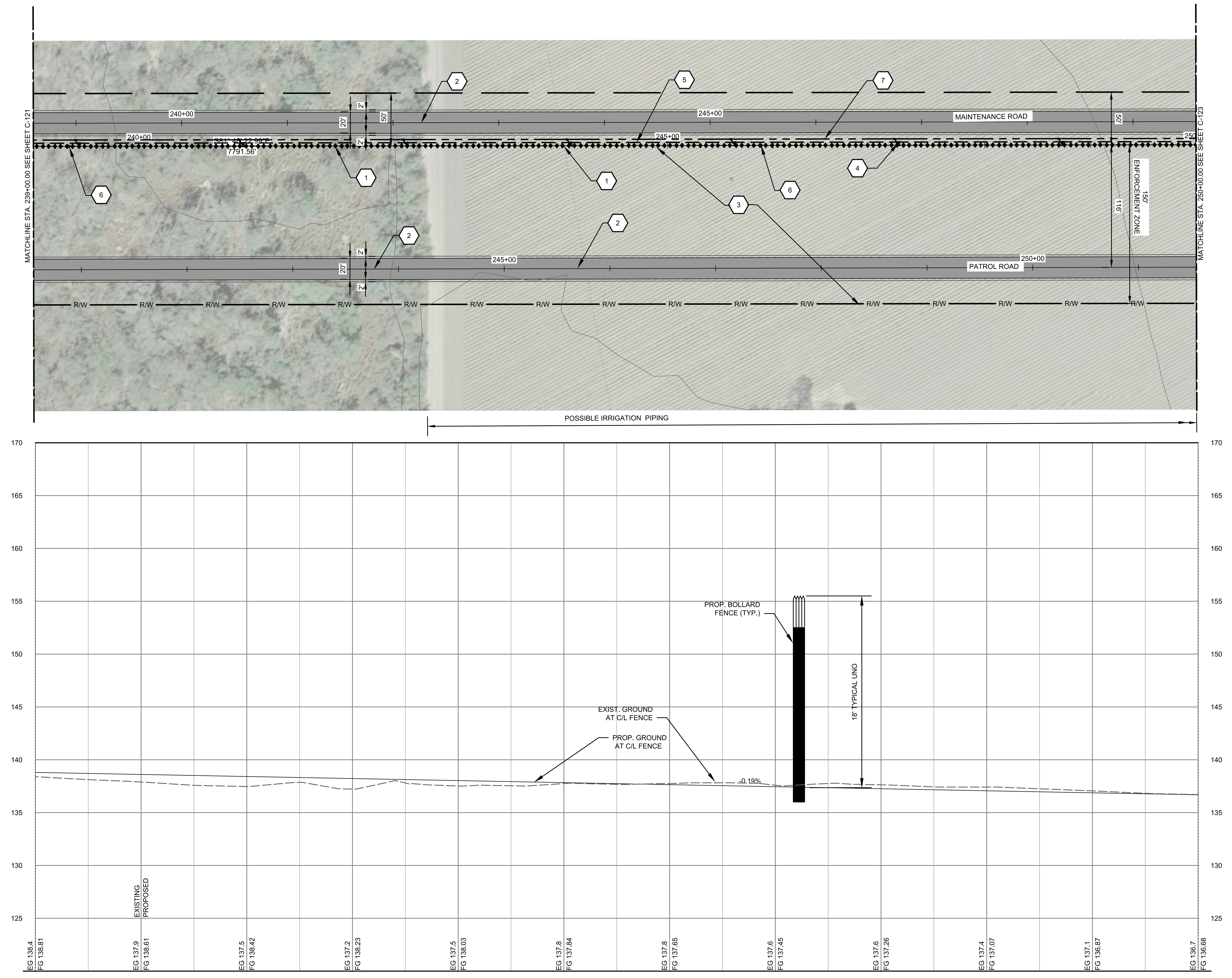
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 228+00.00 - 239+00.00

SHEET ID
LAGRULLA
C-121



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US Army Corps of Engineers ®

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US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
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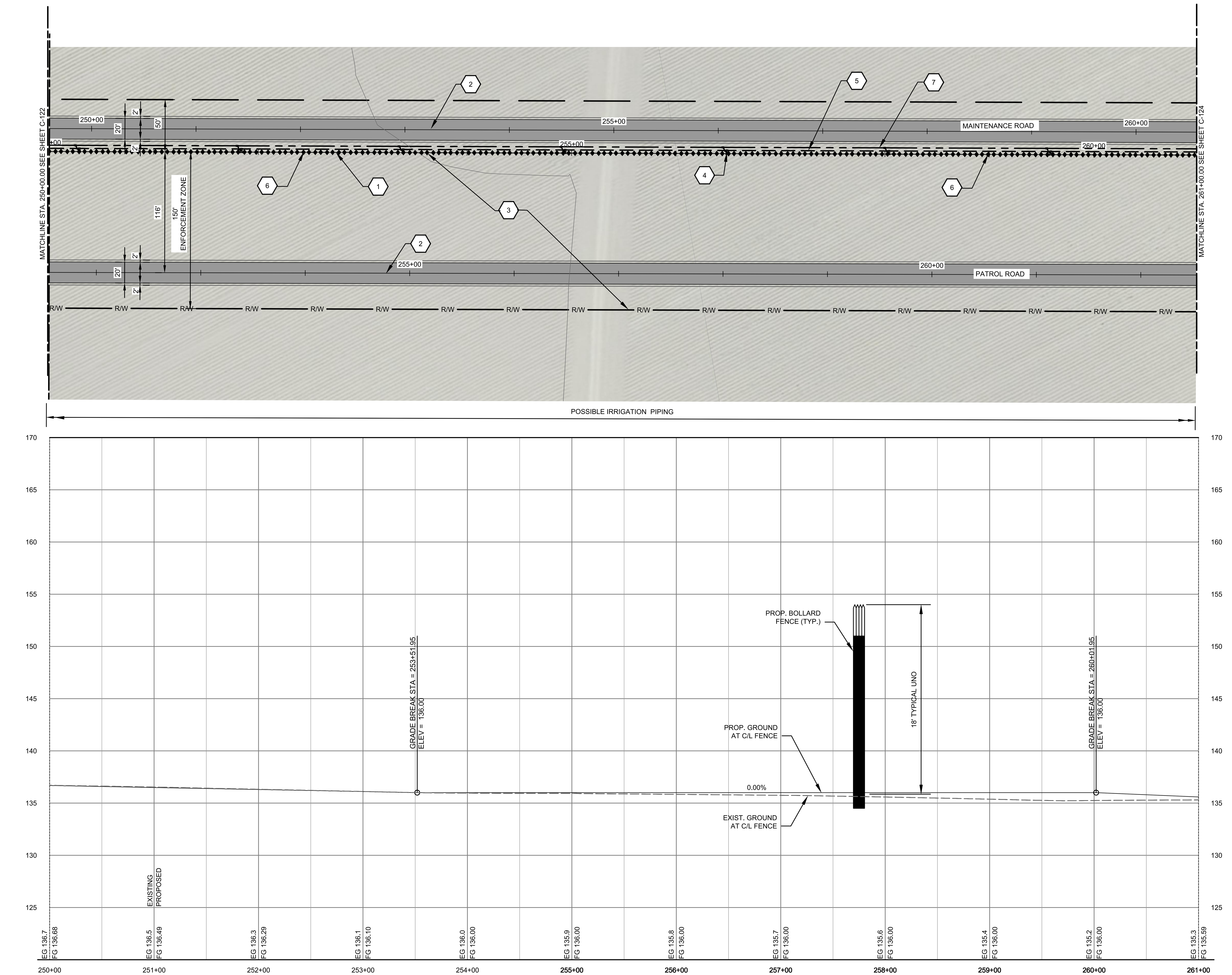
ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 239+00.00 - 250+00.00

SHEET ID
LAGRULLA
C-122



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2. CONTRACTOR IS RESPONSIBLE FOR PERFORMING ALL GEOTECHNICAL TESTING, TOPOGRAPHIC MAPPING, DESIGN, SURVEY STAKE-OUT, ABOVE AND BELOW GROUND UTILITY IDENTIFICATIONS AND REQUIRED RELOCATIONS, AND REMOVAL AND PROPER DISPOSAL OF STRUCTURES, DEBRIS, ETC. LOCATED WITHIN THE ENFORCEMENT ZONE.
3. CONTRACTOR SHALL ENSURE THAT ALL DESIGNS MEET TACTICAL INFRASTRUCTURE STANDARDS, LATEST EDITION.
4. CONTRACTOR SHALL VERIFY LOCATION OF ALL UTILITIES, IRRIGATION CULVERTS AND DRAINAGE STRUCTURES, AND ADJUST/RELOCATE AS REQUIRED TO DE-CONFLICT WITH THE PROPOSED BOLLARD FENCE AND ENFORCEMENT ZONE (I.E.: EX. IRRIGATION VALVES TO BE RELOCATED TO NORTH LEVEE EMBANKMENT).
5. CONTRACTOR SHALL DESIGN AND INSTALL ALL DRAINAGE SYSTEMS FOR THIS PROJECT.
6. LIGHTING LOCATIONS ARE CONCEPTUAL. CONTRACTOR TO PROVIDE FINAL LIGHTING COMPUTATIONS AND LOCATIONS.

XX KEYNOTES

1. PROPOSED NEW TYPE P-3 BOLLARD FENCE.
2. PROPOSED TYPE FC-2 AGGREGATE ALL-WEATHER ROAD.
3. CLEAR VEGETATION AND GRADE WITHIN ENFORCEMENT ZONE.
4. PROPOSED LIGHT POLE, PULLBOX, AND LIGHTING - SEE ELEC. FOR LOCATIONS (TYP).
5. PROPOSED POWER AND LIGHTING DISTRIBUTION CABLE AND CONDUIT/ DUCT BANK.
6. PROPOSED FENCE GROUNDING LOCATION.
7. PROPOSED COMMUNICATION CONDUIT/ DUCTBANK. (CABLE FUTURE BY OTHERS)
8. GATE ELECTRICAL DISTRIBUTION EQUIPMENT.
9. GATE GROUNDING LOCATION
10. PROPOSED MOTORIZED VEHICLE SLIDE GATE.
11. PROPOSED RVSS SITE.
12. CONCEPTUAL ELECTRICAL UTILITY CONNECTION POINT.
13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

DESIGNED BY: X
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SUBMITTED BY: X
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ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

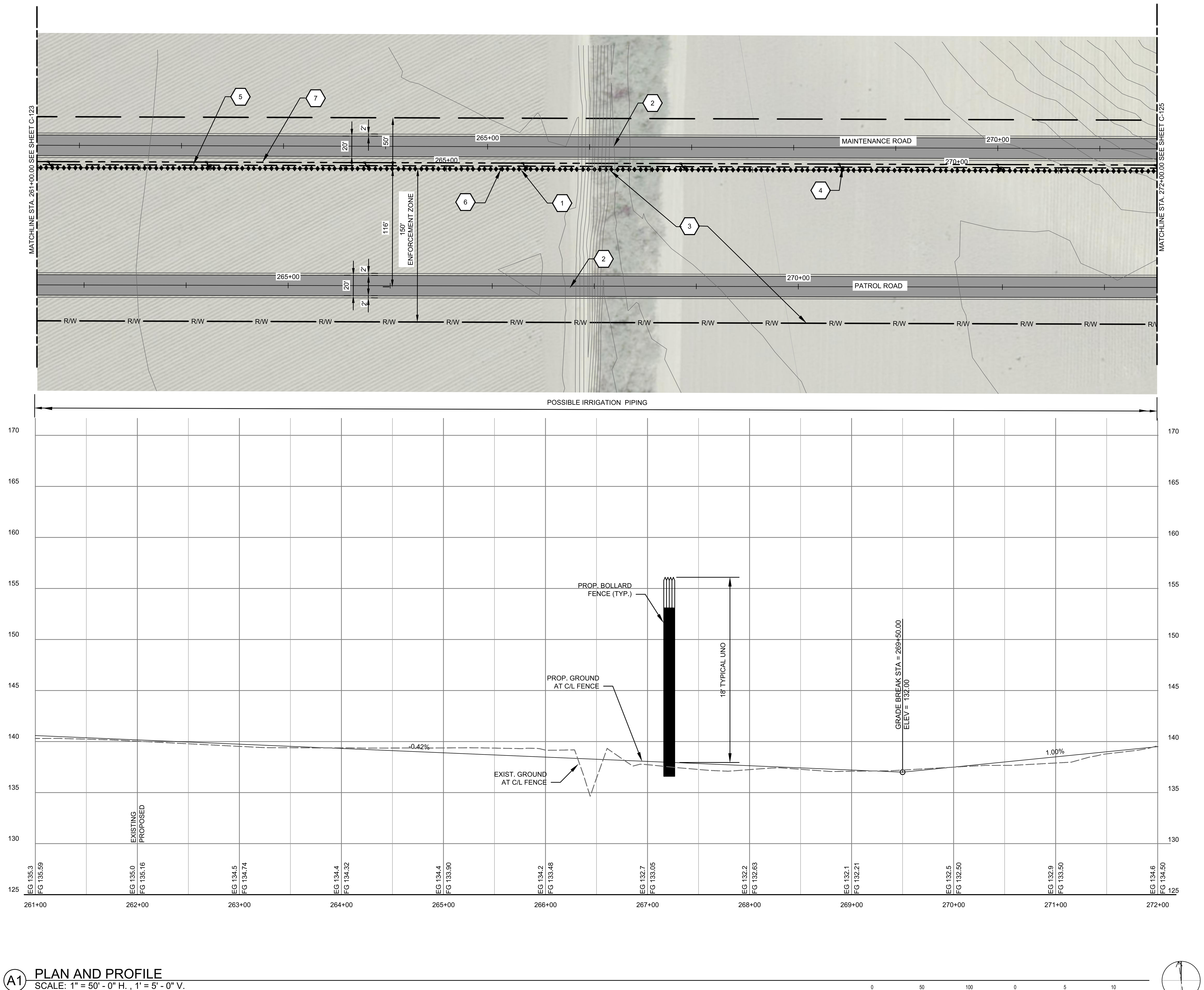
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 250+00.00 - 261+00.00

SHEET ID
LAGRULLA
C-123



A1 PLAN AND PROFILE
SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

1" = 50' - 0"   1' = 5' - 0"

GENERAL NOTES

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9. GATE GROUNDING LOCATION
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13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

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DESIGNED BY: X
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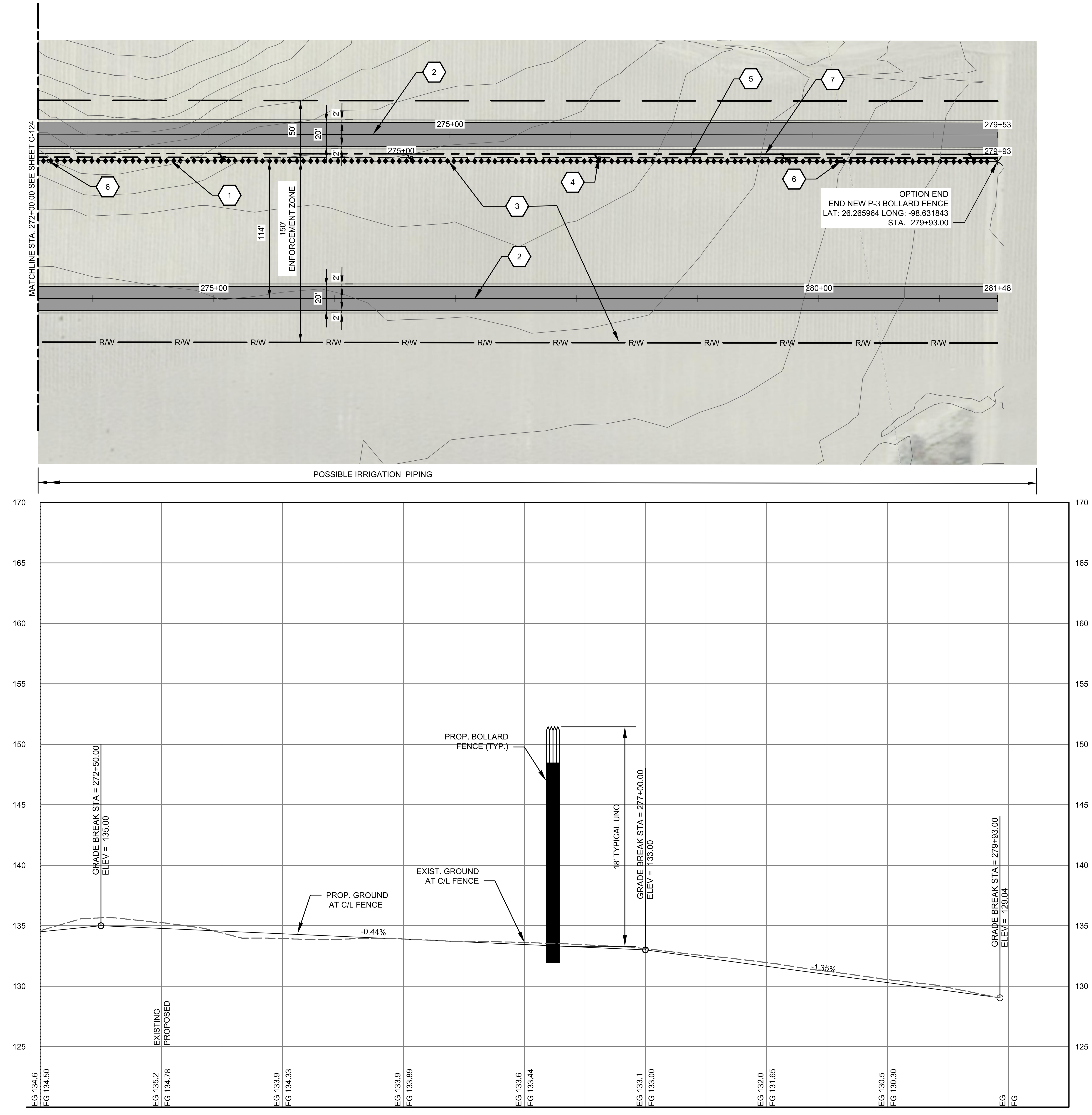
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 261+00.00 - 272+00.00

SHEET ID
LAGRULLA
C-124



A1 PLAN AND PROFILE
SCALE: 1" = 50' - 0" H. , 1' = 5' - 0" V.

1" = 50' - 0"   1' = 5' - 0"

GENERAL NOTES

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12. CONCEPTUAL ELECTRICAL UTILITY CONNECTION POINT.
13. CONTRACTOR TO DIRECTIONALLY BORE BENEATH STRUCTURE FOR CONTINUATION OF COMMUNICATIONS AND ELECTRICAL CONDUITS.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

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ISSUED DATE: | SOLICITATION NO: | CONTRACT NO.: | FILE NUMBER:

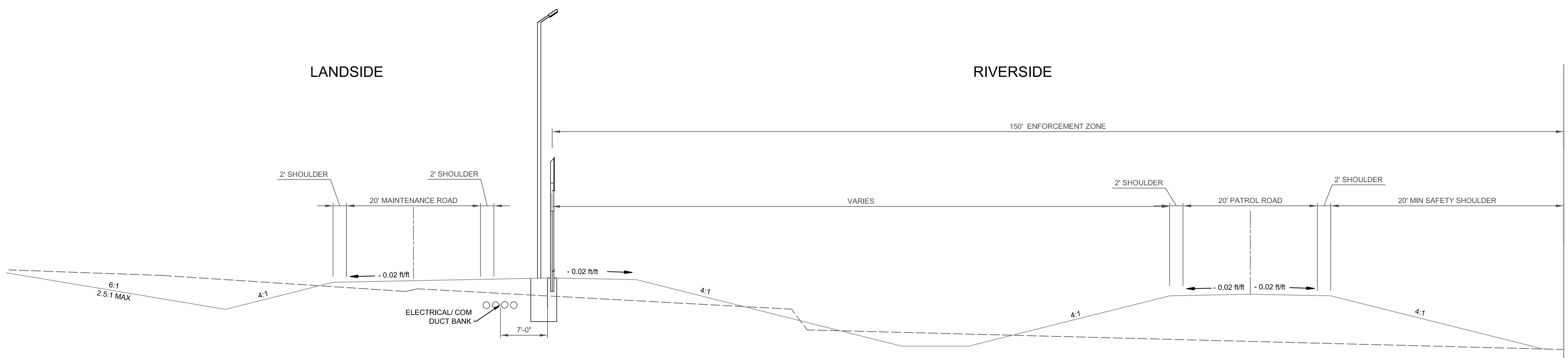
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND PROFILE
STA. 272+00.00 - 279+93.00

SHEET ID
LAGRULLA
C-125



A1 TYPICAL CROSS SECTION
SCALE: 1" = 100'

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

DESIGNED BY: X
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SUBMITTED BY: X
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US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
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GALVESTON, TX 77553-1229

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DALLAS, TX, 75252

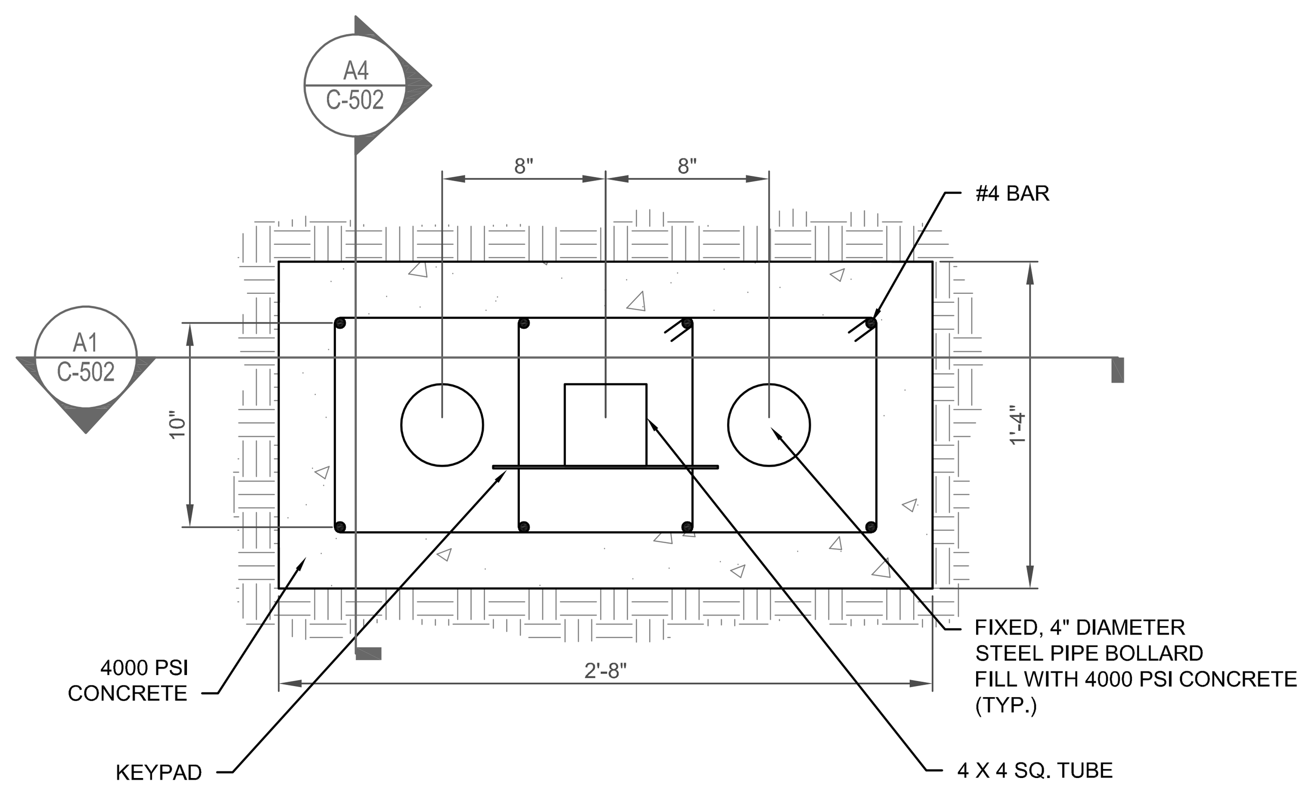
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

TYPICAL CROSSECTION

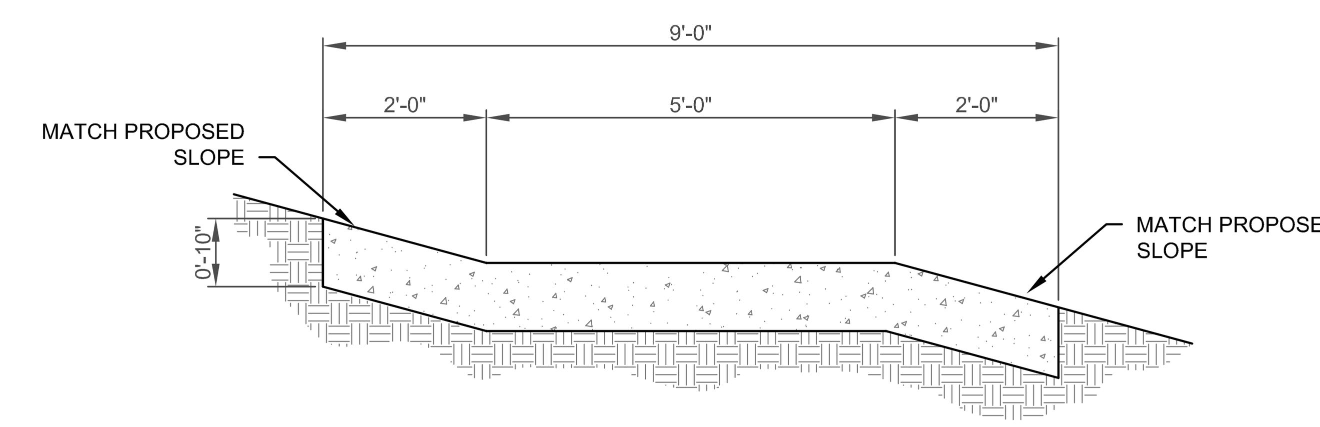
SHEET ID
LAGRULLA
C-301

1 2 3 4 5 6 7 8 9 10

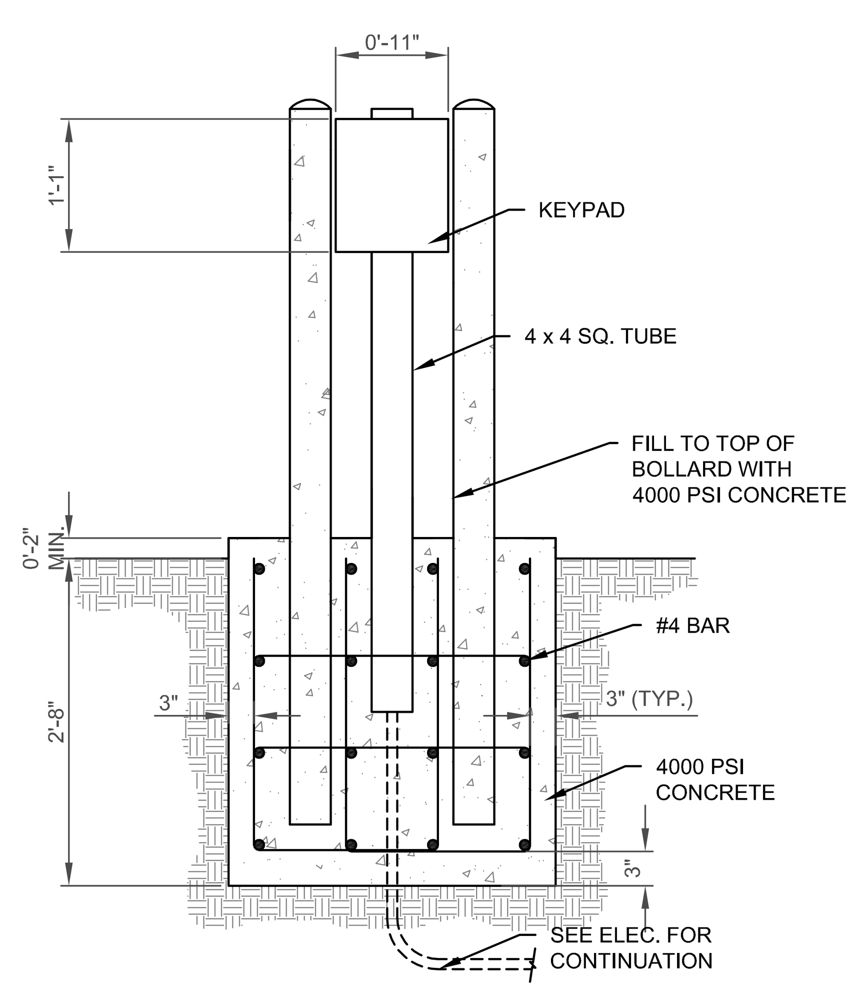
G F E D C B A



D1 KEYPAD MOUNTING DETAIL
SCALE: N.T.S.



C6 10" CONCRETE ROAD CROSSING SLAB
SCALE: N.T.S.



A1 KEYPAD MOUNTING DETAIL
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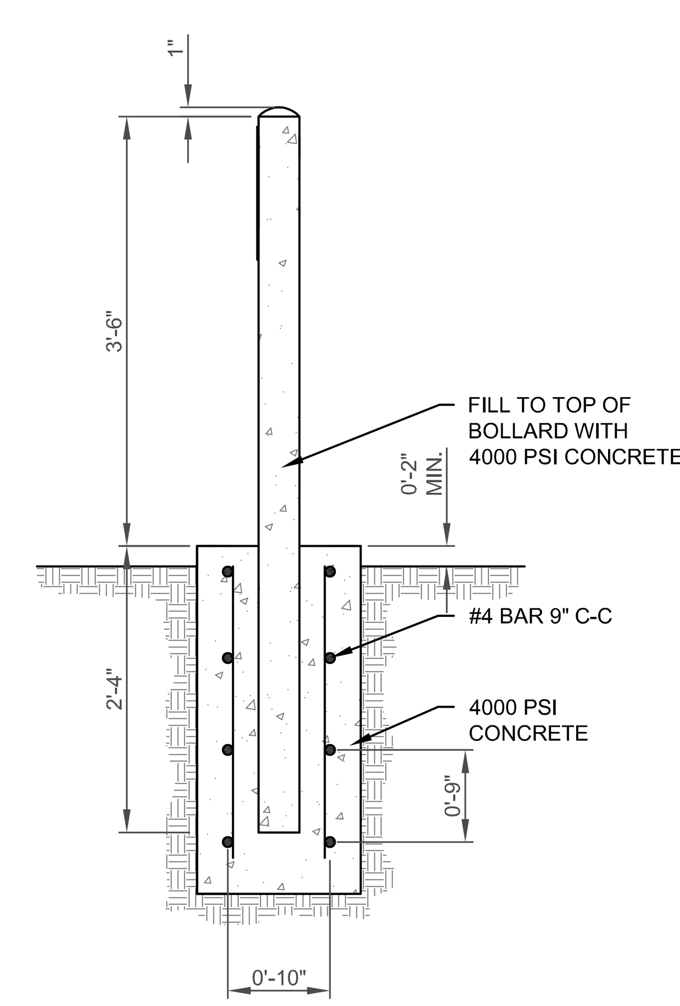
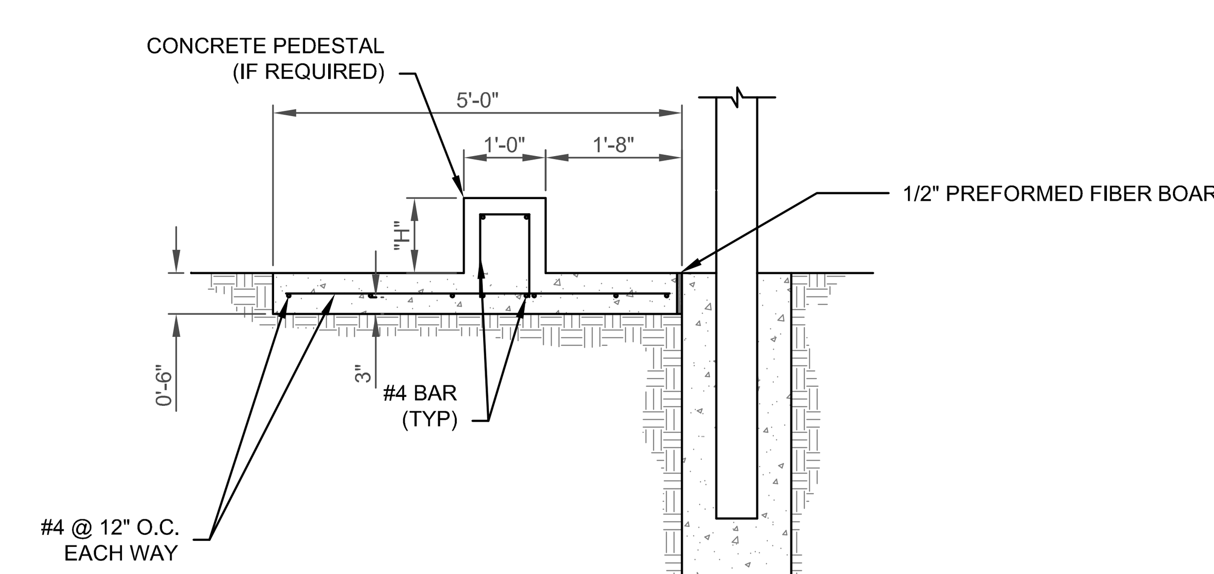


A4 KEYPAD MOUNTING DETAIL
SCALE: N.T.S.



A6 6" CONCRETE SLAB
SCALE: N.T.S.

GENERAL NOTES

US Army Corps
of Engineers ®

MARK	DESCRIPTION	DATE

ISSUED DATE:
SOLICITATION NO:
CONTRACT NO.:
FILE NUMBER:

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CHECKED BY:
B.PRESTON
SUBMITTED BY:
B.PRESTON
SIZE:
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US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

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DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

ROAD CROSSING AND KEYPAD MOUNT DETAILS

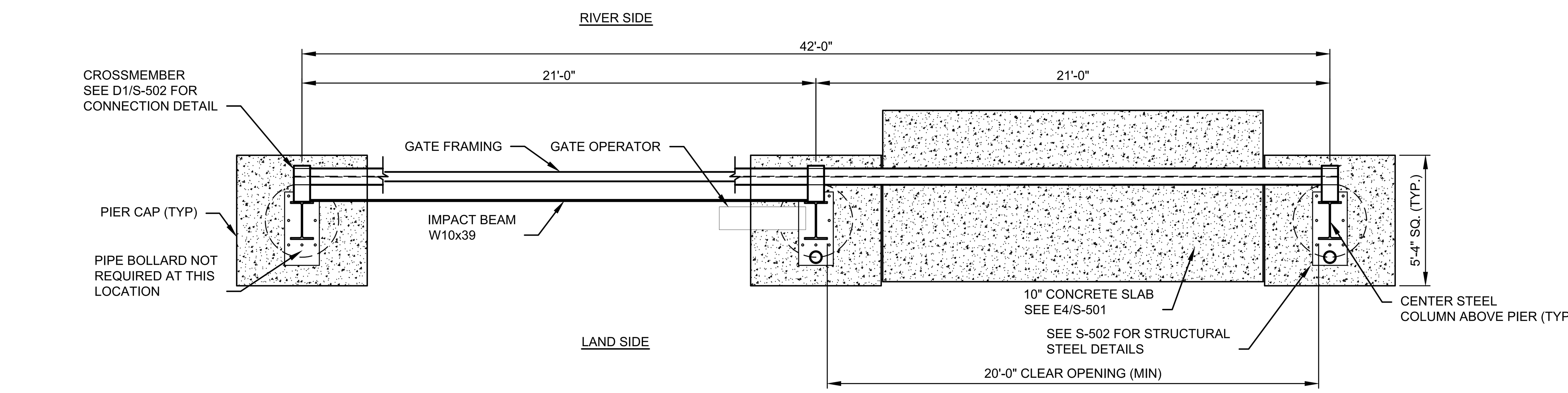
SHEET ID
LAGRULLA
C-501

GENERAL NOTES

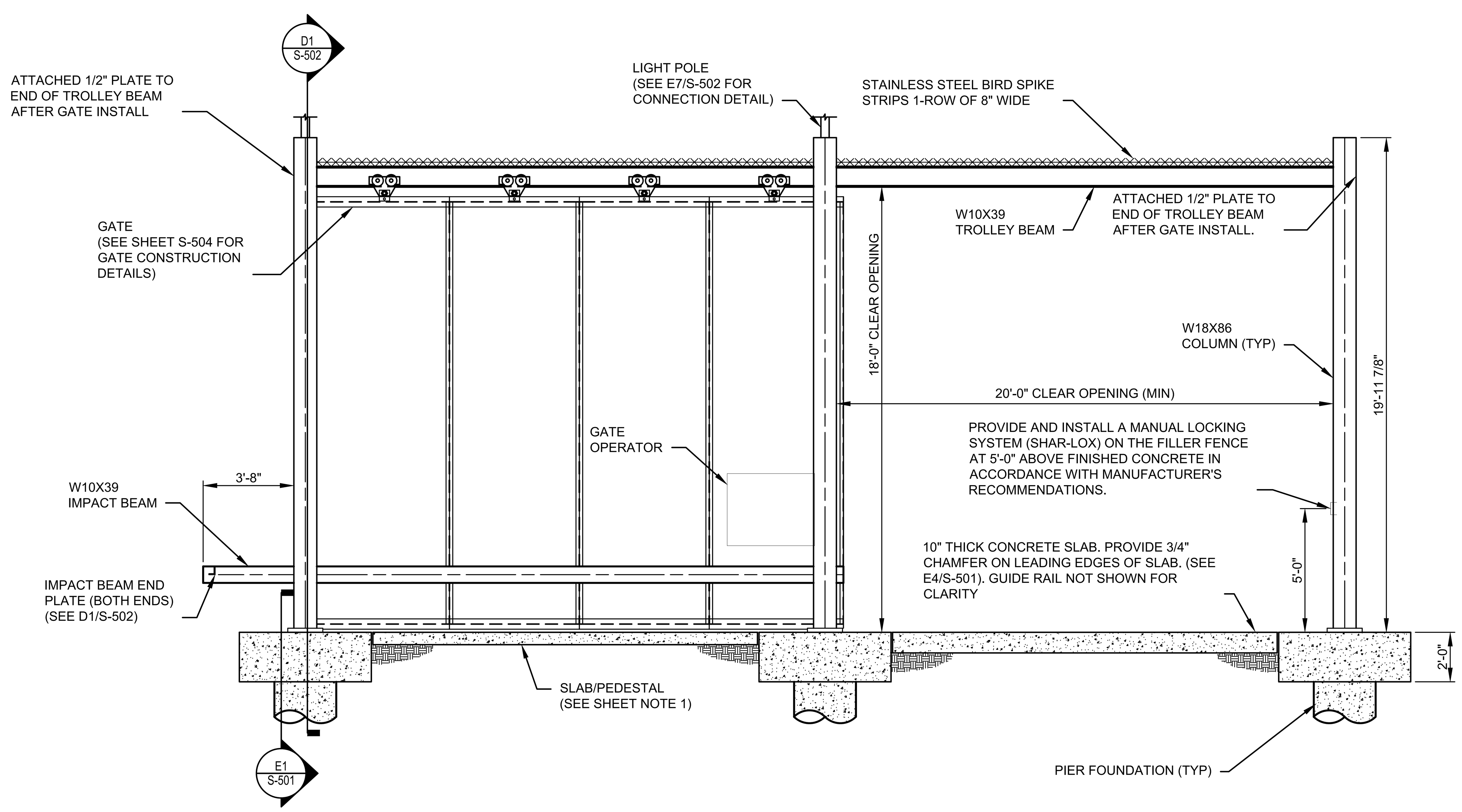
1. FOR BASE PLATE AND BOLT DETAIL REFER TO DRAWING S-501 AND S-502.
2. FOR GATE OPERATOR PLATFORM REFER TO DRAWING S-503.
3. PROVIDE STEEL PLATES, WELDED TO TOP OF COLUMNS #1 AND #2 AND BOLTED TO THE LIGHT POST BASEPLATE. SEE DETAIL E7/S-502 FOR DETAILS.
4. ANY GAP BETWEEN FENCE AND GATE SHALL BE NO MORE THAN 4".
5. EARTHWORK SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 31 00 00.
6. INSTALL 1 1/2" DIA GALVANIZED STEEL LADDER TO ACCESS GATE OPERATOR. LADDER RUNGS SHALL BE EQUALLY SPACE (8") 1" SQ GALVANIZED STEEL BARS WITH NON-SLIP TREATMENT ON TOP OF EACH RUNG. PAINT WELDED SURFACES WITH A CORROSION PROTECTIVE COATING AS NEEDED.
7. MINIMUM LADDER OPENING IS 16" IN WIDTH.

SHEET NOTES

1. SEE SHEET C-501 FOR CROSSING SLAB INFORMATION.
2. SEE SHEET C-501 FOR 6" CONCRETE SLAB INFORMATION.



E2 PLAN - 20 FT. AUTOMATED GATE
SCALE: N.T.S.



A2 ELEVATION - 20 FT. AUTOMATED GATE (LOOKING TOWARD RIVER SIDE)
SCALE: N.T.S.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

DESIGNED BY: X
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SUBMITTED BY: X
SIZE: ANSI D
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US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
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GALVESTON, TX 77553-1229

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DALLAS, TX, 75252

RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND ELEVATION
20 FT. SINGLE LEAF AUTOMATED GATE

SHEET ID
LAGRULLA
S-101

GENERAL NOTES

1. FOR BASE PLATE AND BOLT DETAIL REFER TO DRAWING S-501 AND S-502.
2. FOR GATE OPERATOR PLATFORM REFER TO DRAWING S-503.
3. PROVIDE STEEL PLATES, WELDED TO TOP OF COLUMNS #1 AND #2 AND BOLTED TO THE LIGHT POST BASEPLATE. SEE DETAIL E7/S-502 FOR DETAILS.
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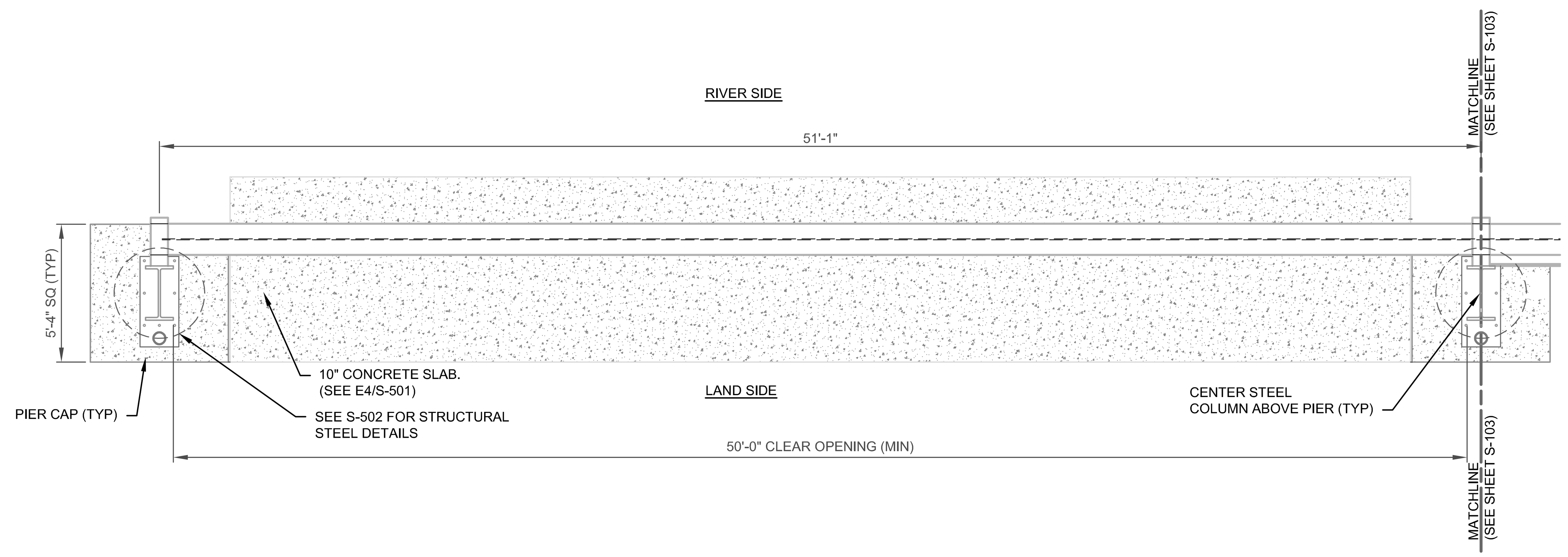
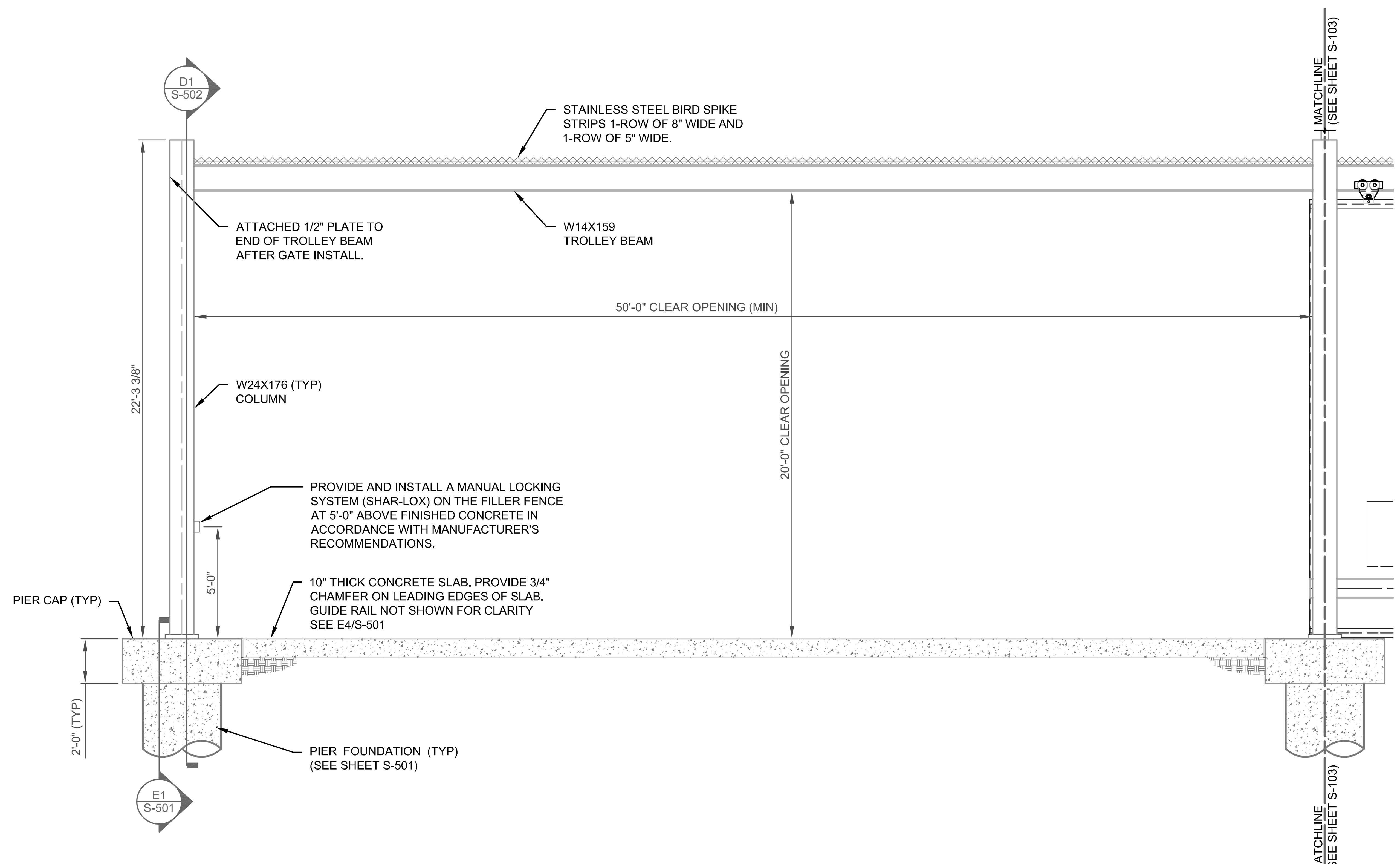
6. INSTALL 1 1/2" DIA GALVANIZED STEEL LADDER TO ACCESS GATE OPERATOR. LADDER RUNGS SHALL BE EQUALLY SPACE (8") 1" SQ GALVANIZED STEEL BARS WITH NON-SLIP TREATMENT ON TOP OF EACH RUNG. PAINT WELDED SURFACES WITH A CORROSION PROTECTIVE COATING AS NEEDED.
7. MINIMUM LADDER OPENING IS 16" IN WIDTH.

SHEET NOTES

1. SEE SHEET C-501 FOR CROSSING SLAB INFORMATION.

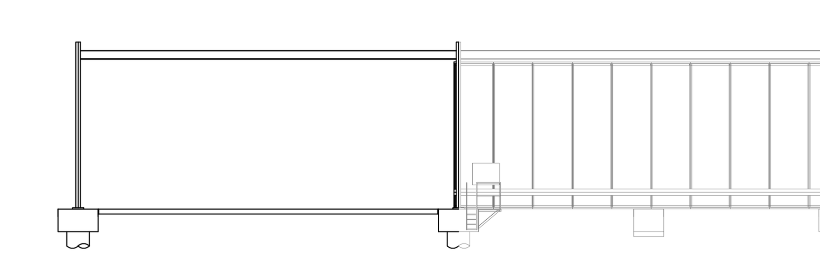


E2 PLAN - 50 FT. AUTOMATED GATE
SCALE: N.T.S



A2 ELEVATION - 50 FT. AUTOMATED GATE (LOOKING TOWARD RIVER SIDE)
SCALE: N.T.S

KEYPLAN



US Army Corps of Engineers ®

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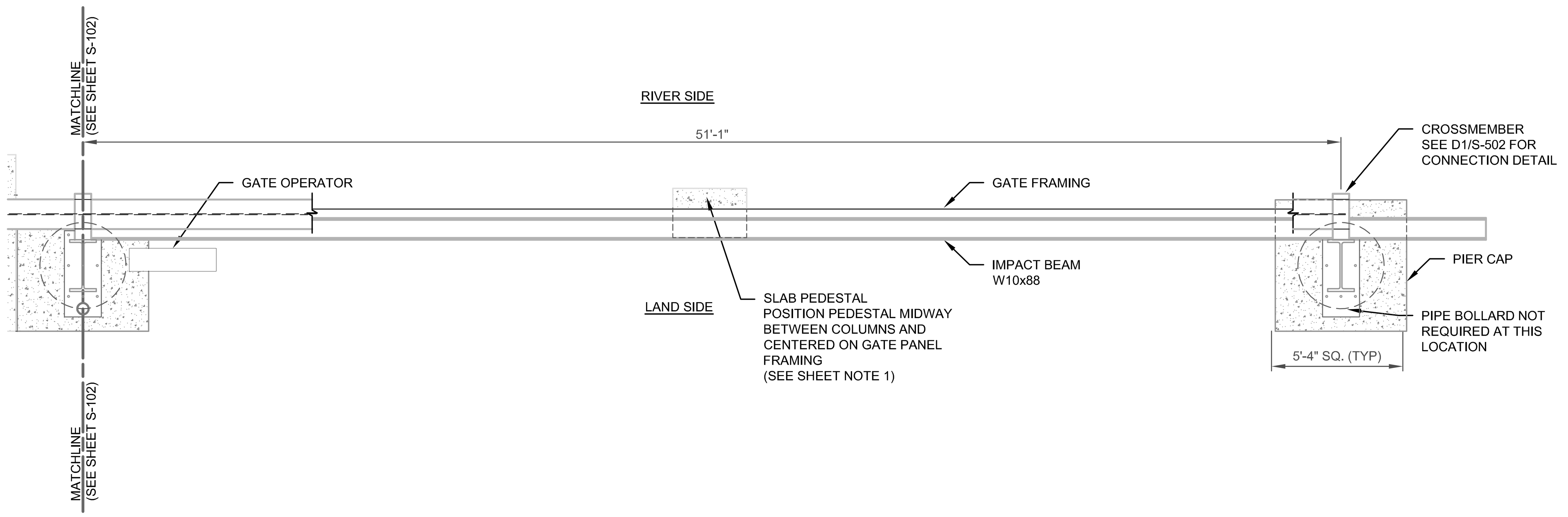
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

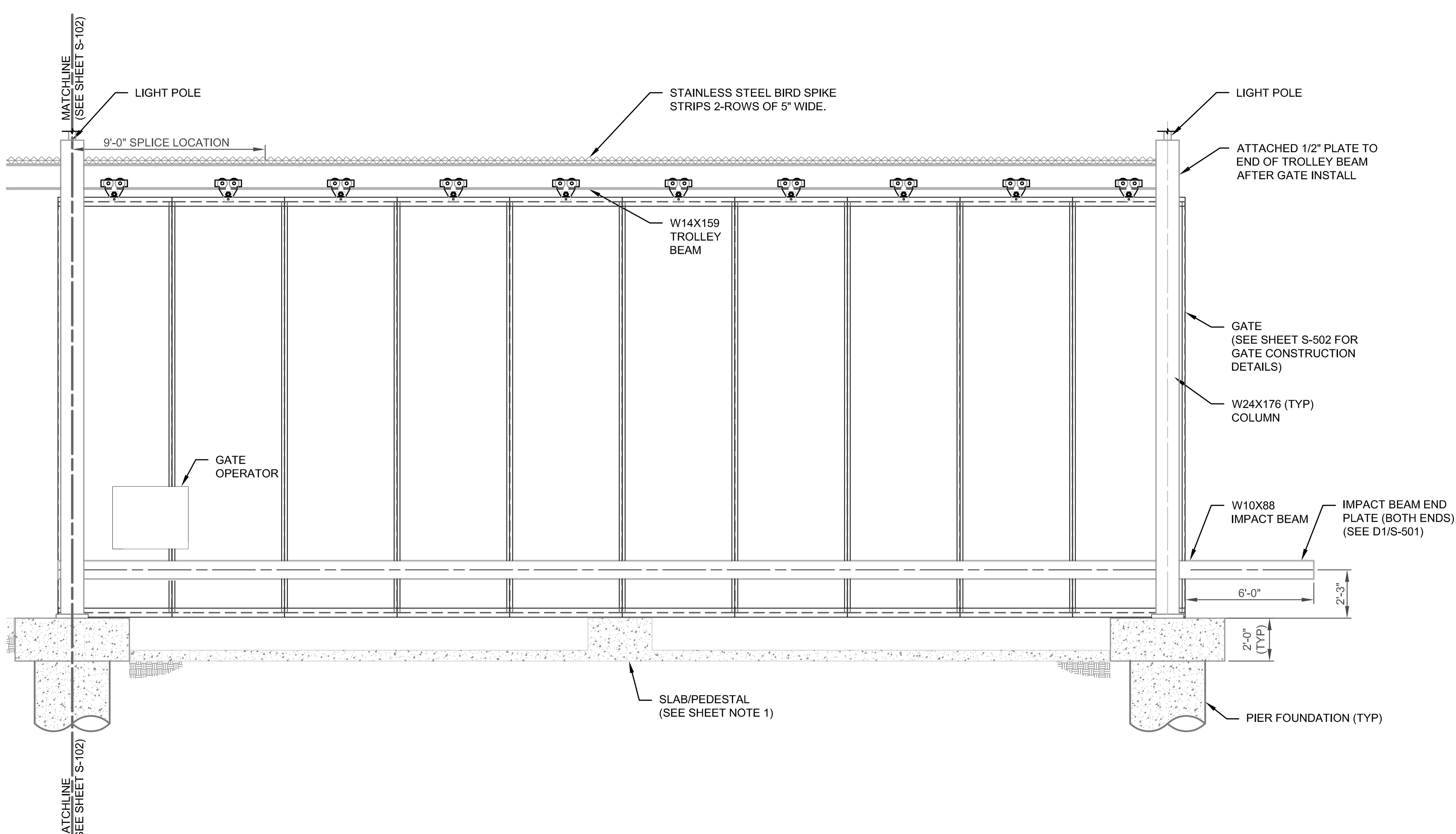
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

PLAN AND ELEVATION
50 FT. SINGLE LEAF AUTOMATED GATE

SHEET ID
LAGRULLA
S-102



E2 PLAN - 50 FT. AUTOMATED GATE
SCALE: N.T.S.



A2 ELEVATION - 50 FT. AUTOMATED GATE (LOOKING TOWARD RIVER SIDE)
SCALE: N.T.S.

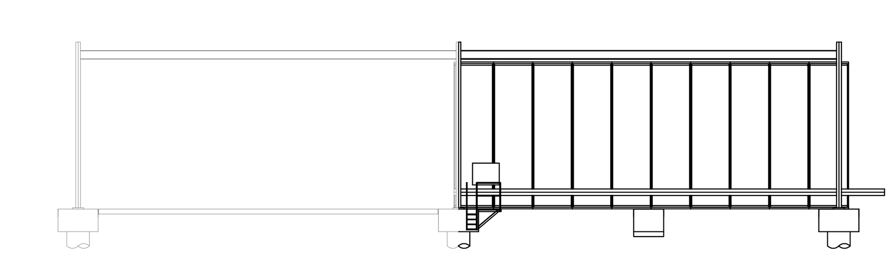
GENERAL NOTES

1. SEE S-102.

SHEET NOTES

1. SEE SHEET C-501 SLAB PEDESTAL INFORMATION.

KEYPLAN



US Army Corps
of Engineers ®

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US ARMY CORPS OF ENGINEERS
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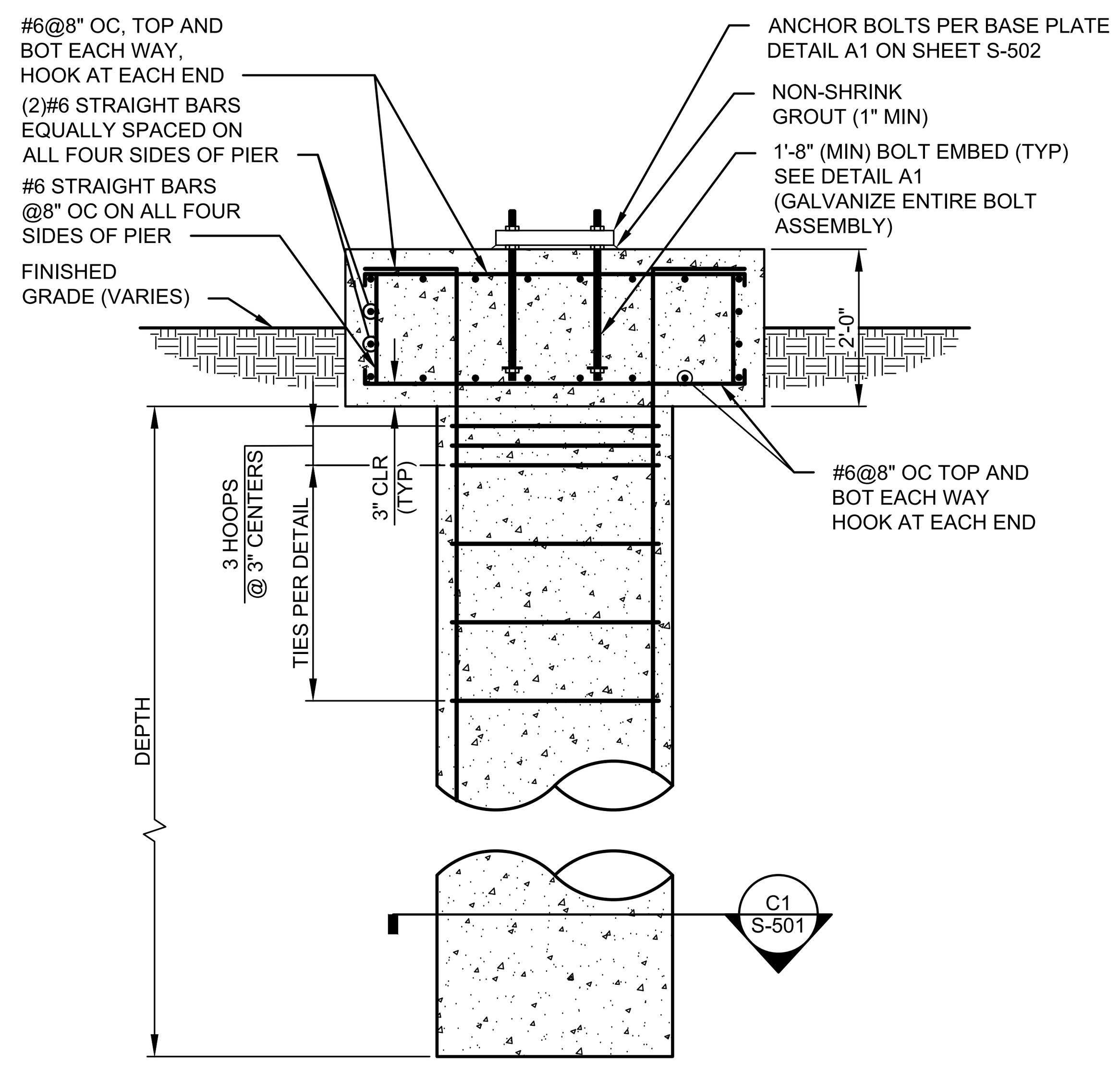
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

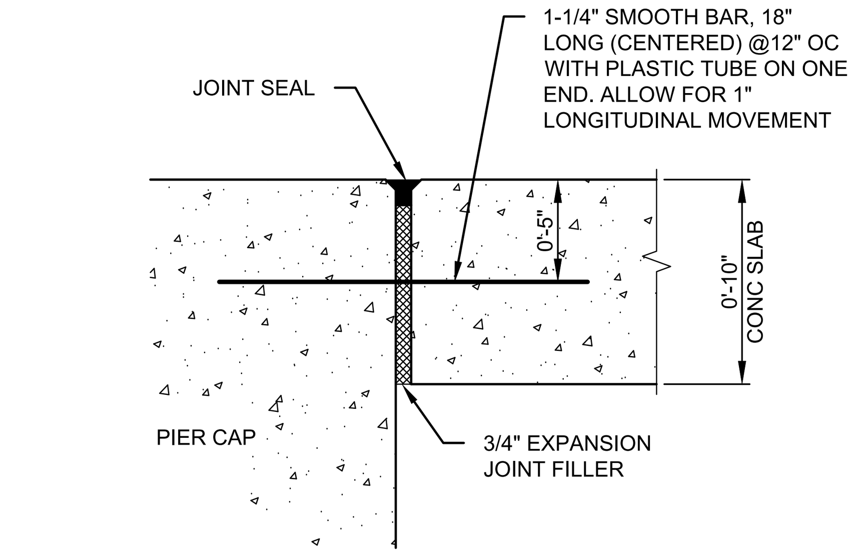
PLAN AND ELEVATION
50 FT. SINGLE LEAF AUTOMATED GATE

SHEET ID
LAGRULLA
S-103

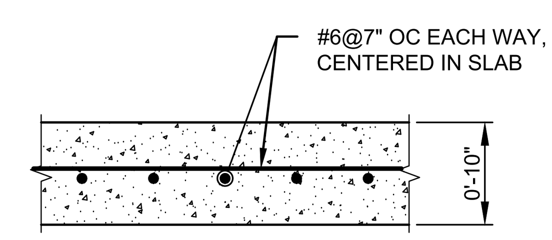
1 2 3 4 5 6 7 8 9 10



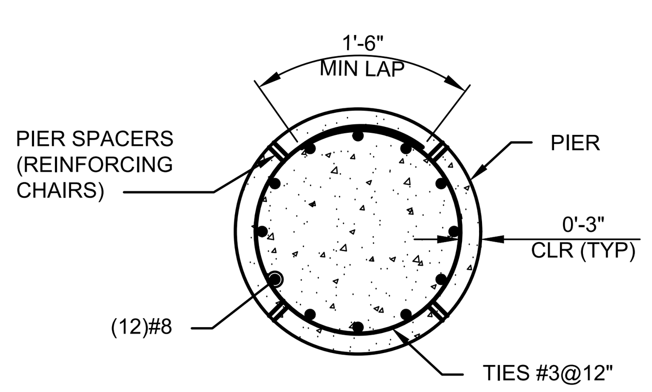
E1 PIER FOUNDATION / PILE CAP REINFORCING DETAIL
SCALE: N.T.S.



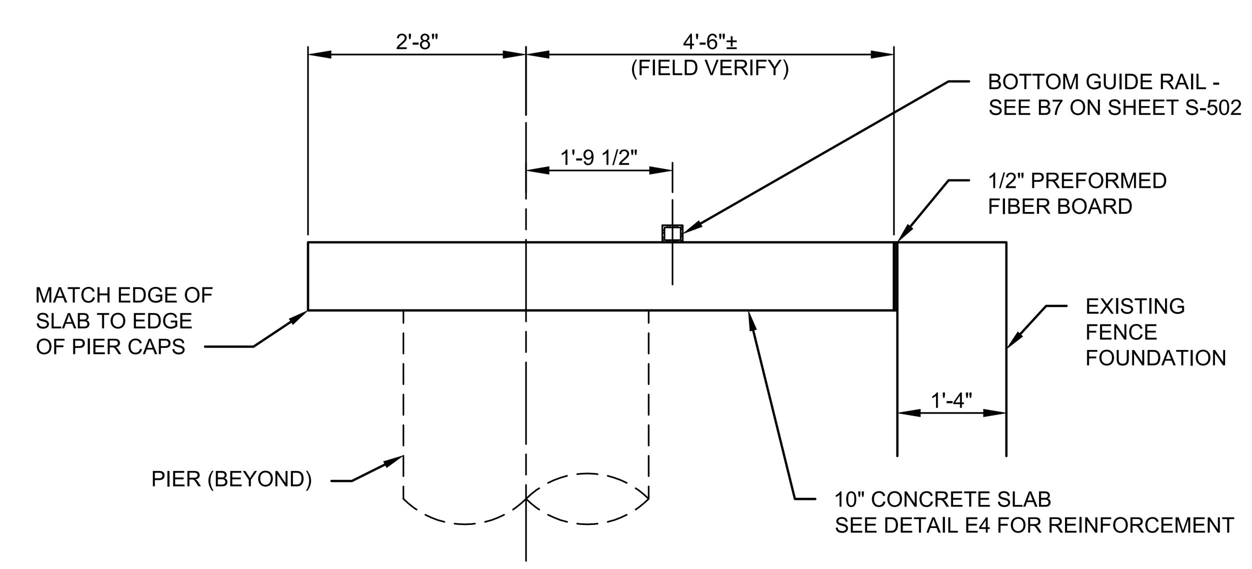
F4 SLEEVED EXPANSION JOINT
SCALE: N.T.S.



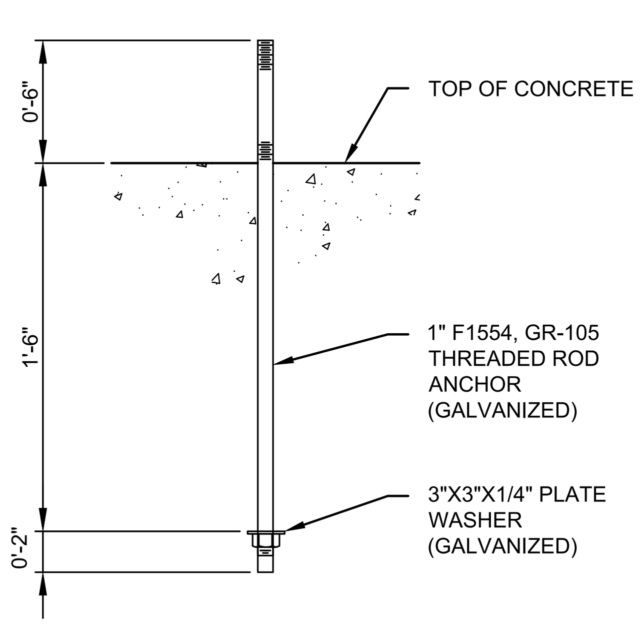
E4 CONCRETE SLAB REINFORCING
SCALE: N.T.S.



C1 PIER FOUNDATION SECTION
SCALE: N.T.S.



C4 CONCRETE SLAB SIZING DETAIL
SCALE: N.T.S.



A1 ANCHOR BOLT DETAIL
SCALE: N.T.S.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

DESIGNED BY: X
DRAWN BY: X
CHECKED BY: X
SUBMITTED BY: X
SIZE: ANSI D
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FILE NUMBER:

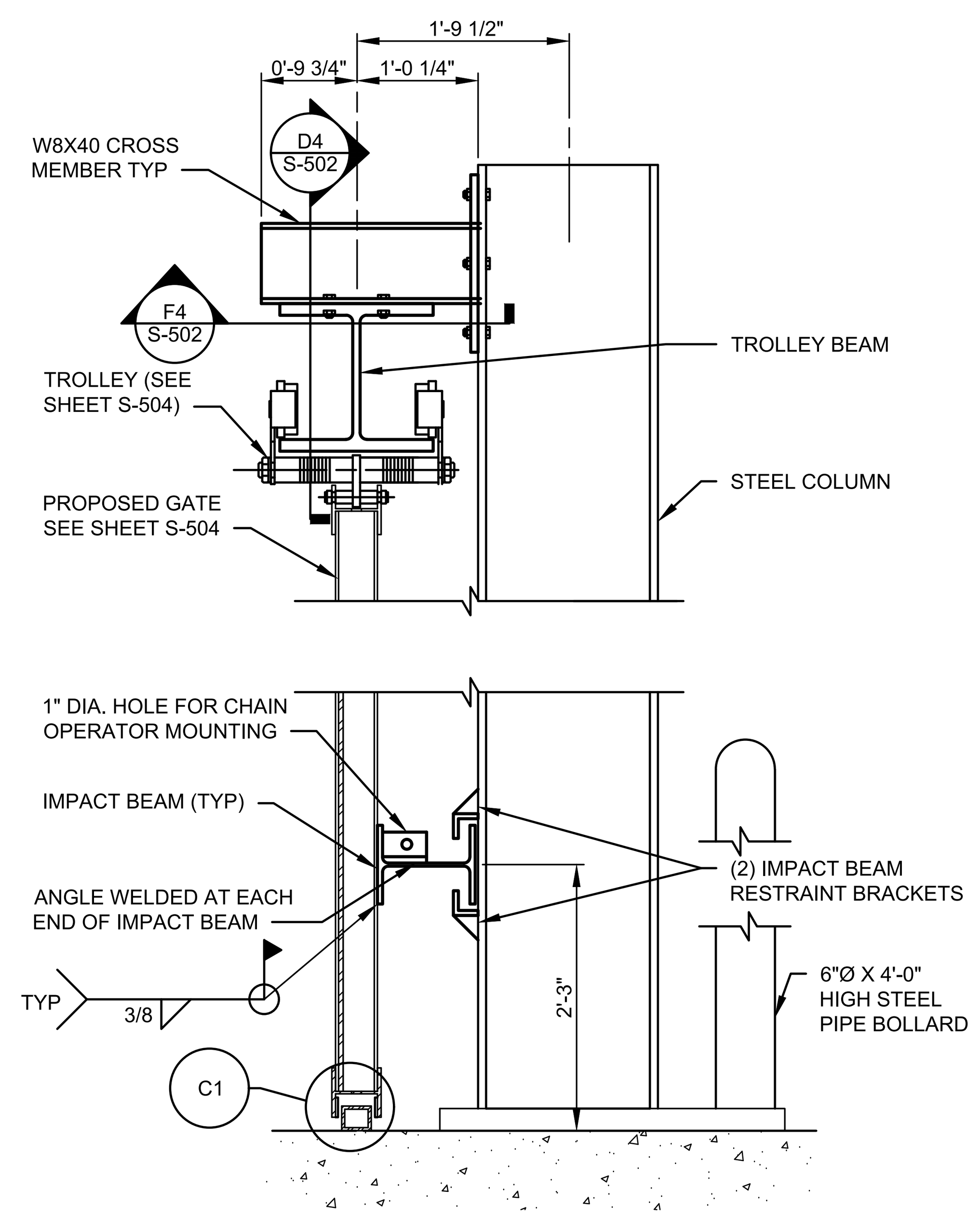
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
17218 PRESTON RD., SUITE 3300
DALLAS, TX, 75252

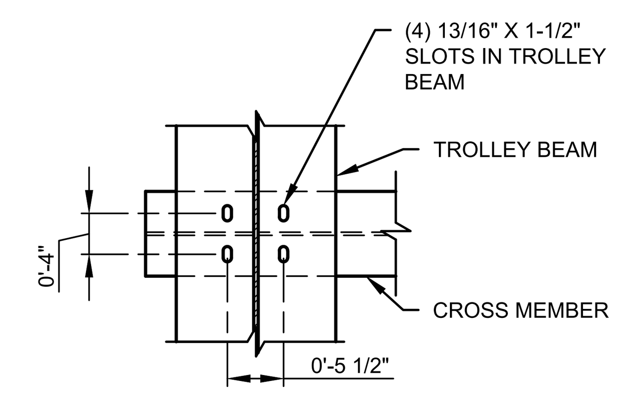
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

CONCRETE DETAILS

SHEET ID
LAGRULLA
S-501



D1 STRUCTURAL COLUMN SECTION
SCALE: N.T.S.



F4 DETAIL
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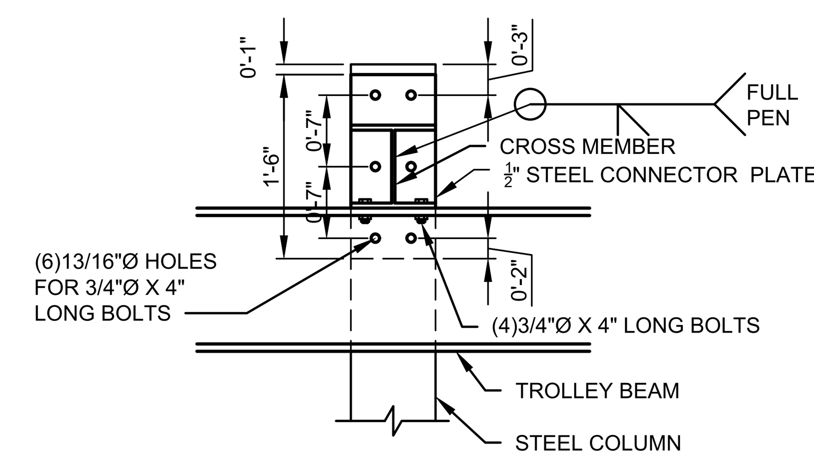
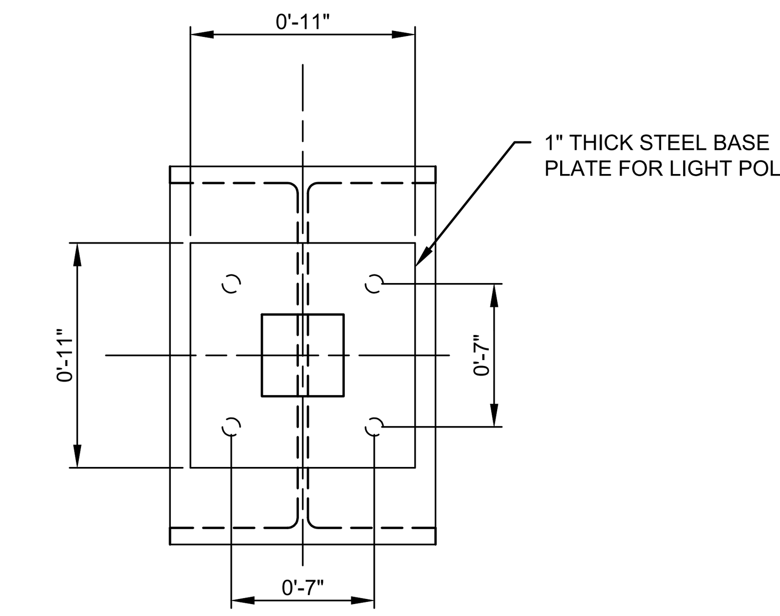
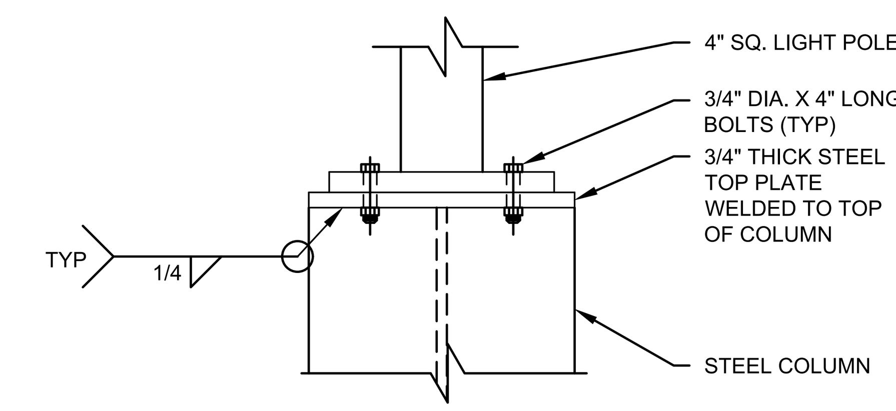
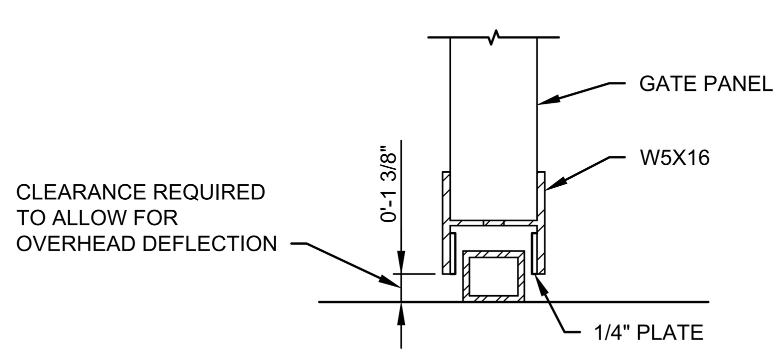


D4 DETAIL
SCALE: N.T.S.

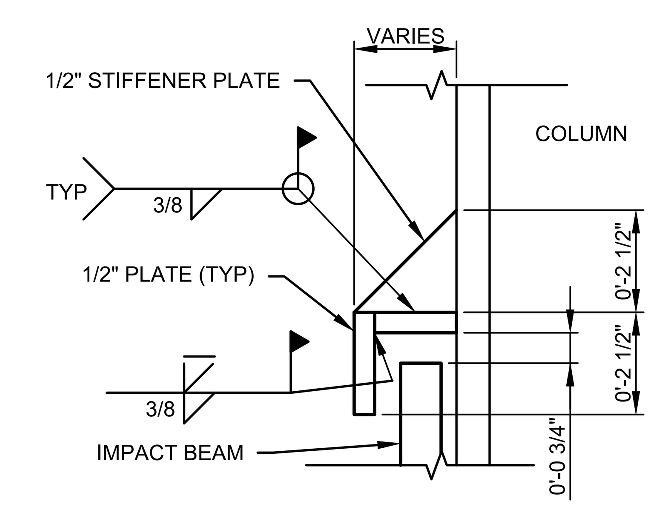




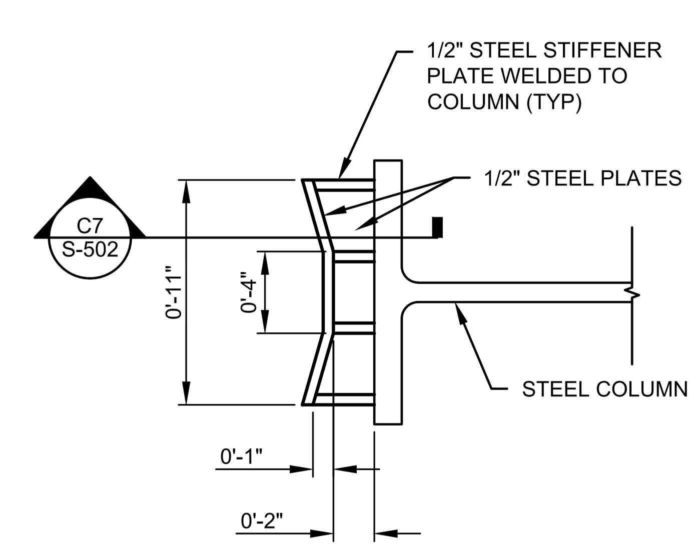
E7 DETAIL - LIGHT POLE CONNECTION
SCALE: N.T.S.



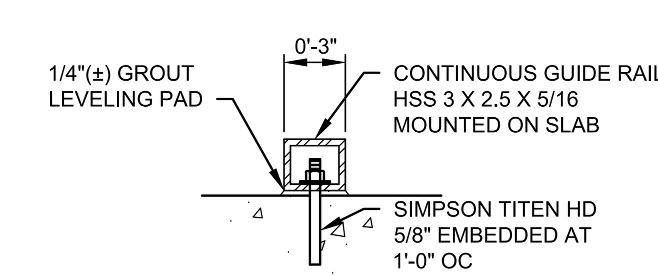
C1 BOTTOM RAIL GUIDE
SCALE: N.T.S.



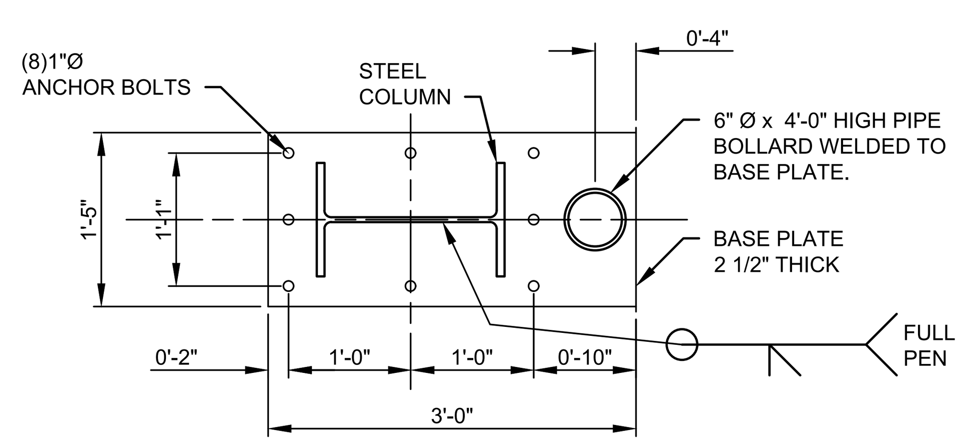
C7 IMPACT BEAM SECTION
SCALE: N.T.S.



B4 DETAIL - IMPACT BEAM BRACKETS
SCALE: N.T.S.



B7 BOTTOM RAIL DETAIL
SCALE: N.T.S.



A1 DETAIL - COLUMN BASE PLATE
SCALE: N.T.S.

GENERAL NOTES

SHEET NOTES

1. INSTALL DRAINAGE HOLES AT 1'-0" O.C. ON THE IMPACT BEAM.
2. BOLLARDS SHALL BE INSTALLED ONLY BY COLUMNS NEXT TO THE ROAD.
3. SEAL INSTALLATION HOLES ON THE GUIDE RAIL.

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SUBMITTED BY: X
SIZE: ANSI D

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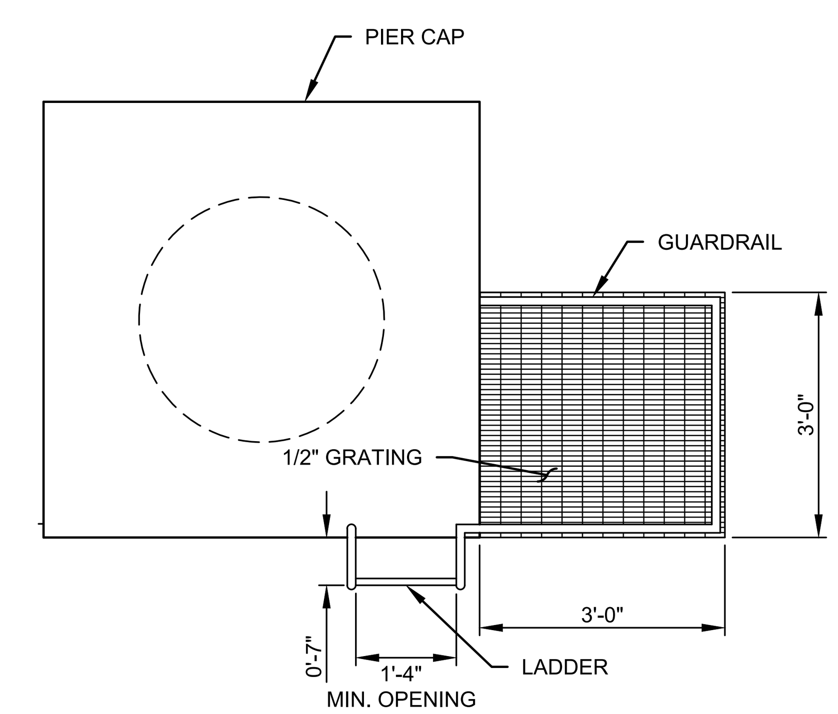
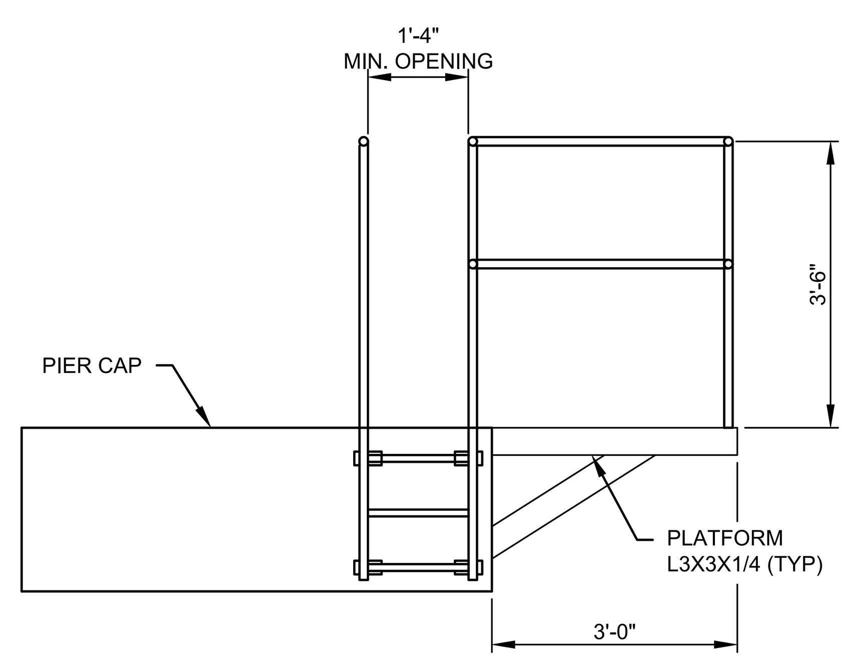
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE
STRUCTURAL DETAILS

SHEET ID
LAGRULLA
S-502



E1 OPERATOR PLATFORM - PLAN
SCALE: N.T.S.



C1 OPERATOR PLATFORM - ELEVATION
SCALE: N.T.S.

GENERAL NOTES

SHEET NOTES

1. ACCESS LADDER NOT REQUIRED ON THE SITE IF DIFFERENCE BETWEEN TOP OF PIER CAP AND GRADE IS 1'-0" OR LESS.
2. CONTRACTOR TO DESIGN OPERATOR PLATFORM WHERE REQUIRED.

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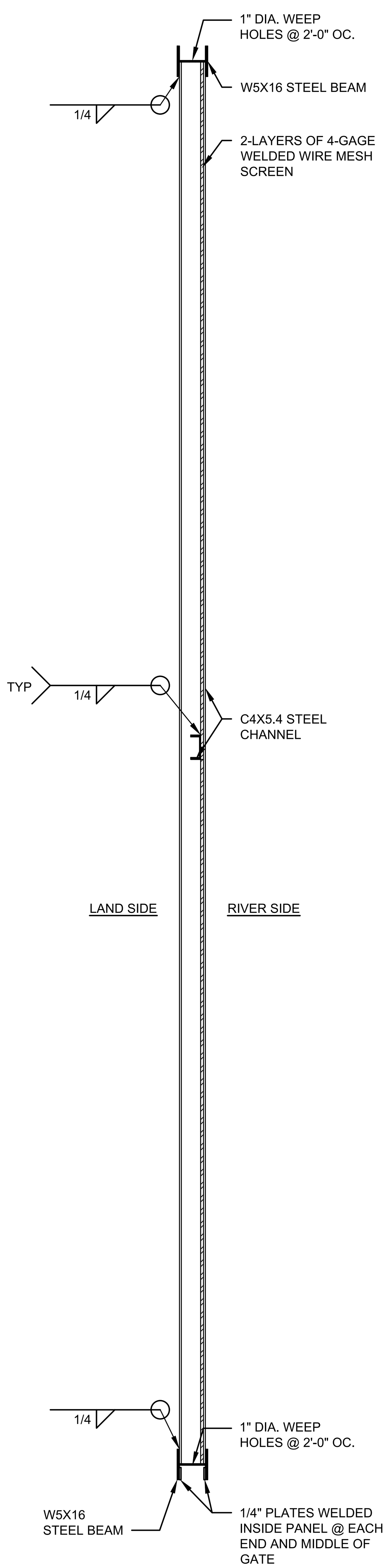
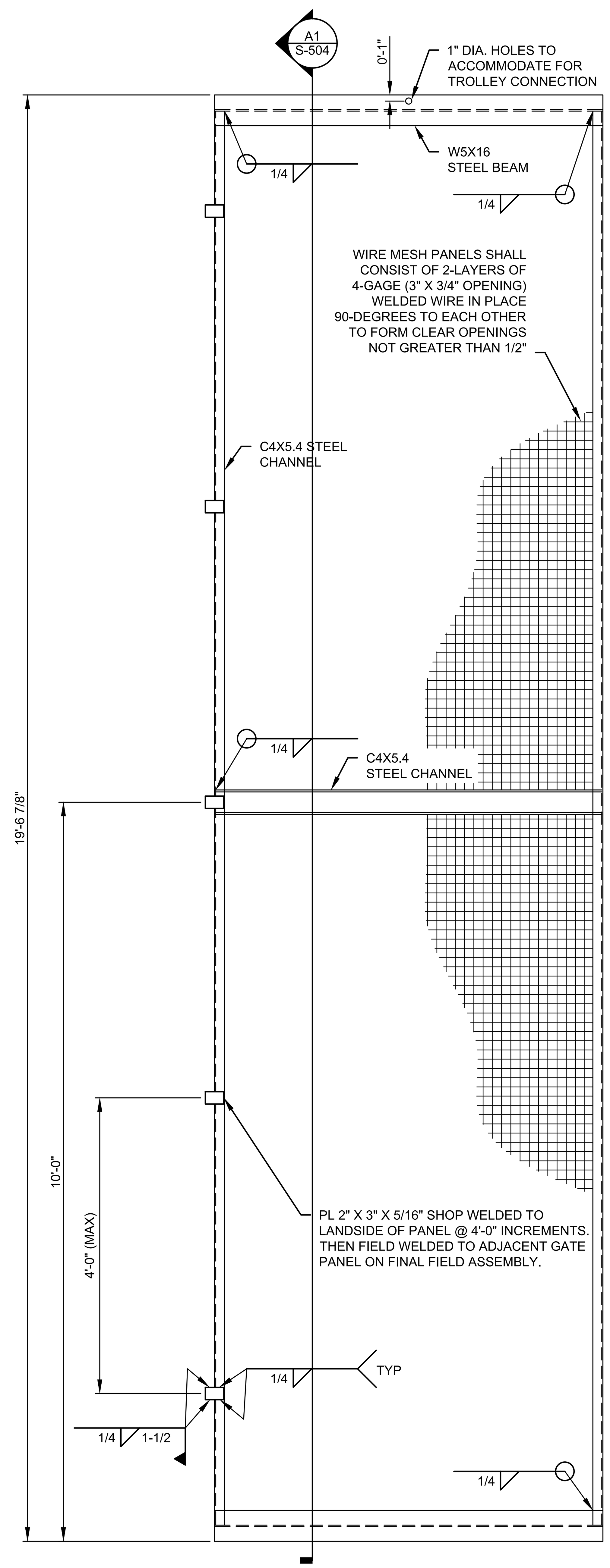
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE
STRUCTURAL DETAILS

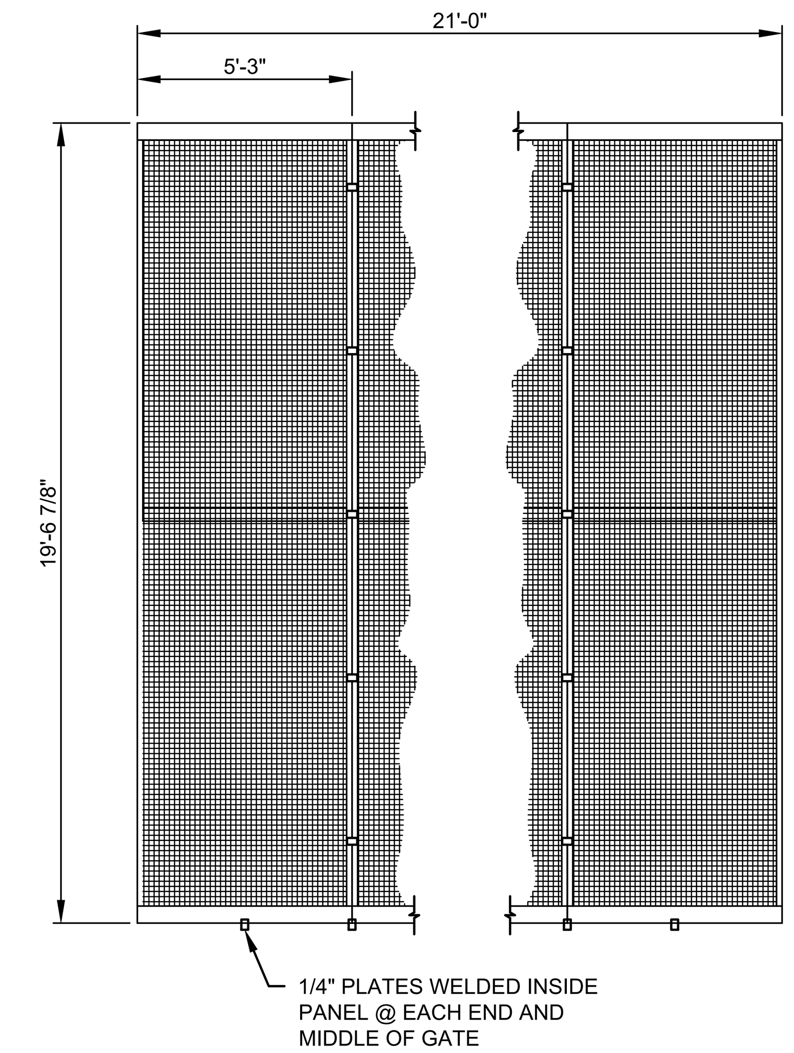
SHEET ID
LAGRULLA
S-503



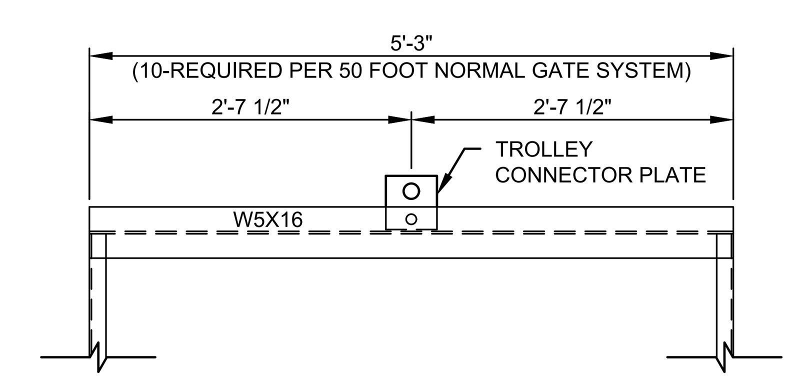
A1 SECTION
SCALE: N.T.S.



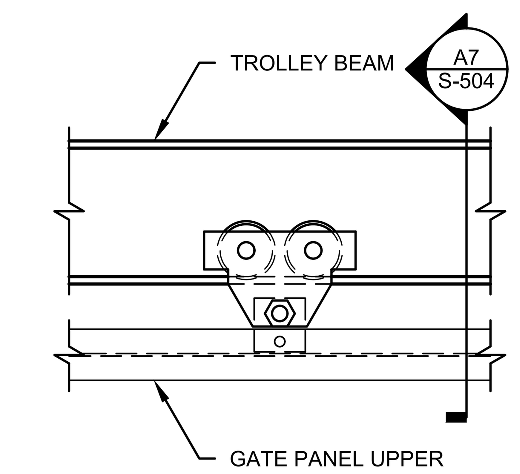
A3 ELEVATION
SCALE: N.T.S.



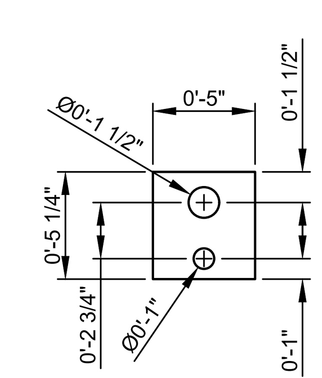
E5 ELEVATION - WIRE MESH GATES (TYP.)
SCALE: N.T.S.



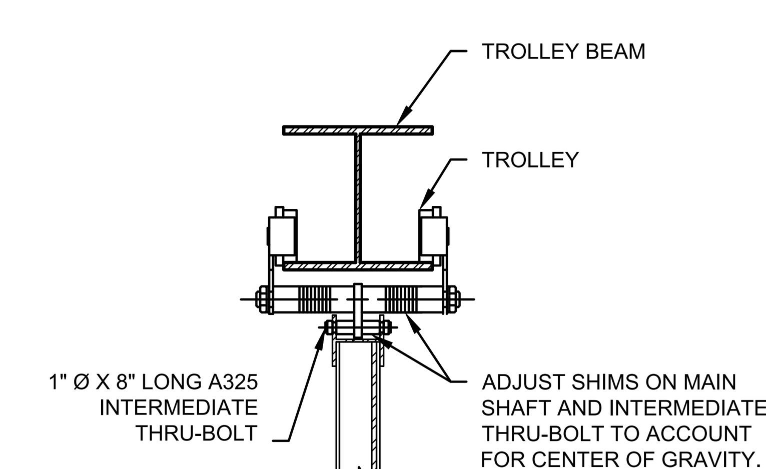
C5 DETAIL - TROLLEY CONNECTOR PLATE
SCALE: N.T.S.



C7 DETAIL - TROLLY CONNECTION
SCALE: N.T.S



A5 DETAIL - TROLLEY CONNECTOR PLATES
SCALE: N.T.S.



A7 SECTION THROUGH TROLLEY
SCALE: N.T.S.

GENERAL NOTES

SHEET NOTES

1. JOIN COMPLETED PANELS TOGETHER IN FIELD USING WELD PLATES AND STITCH WELDS AS SHOWN.
2. AFTER GATE PANELS ARE ASSEMBLED, ATTACH OPERATOR GUIDE RAIL, IMPACT BEAM, AND OTHER APPURTENANCES IN THEIR APPROPRIATE POSITIONS FOR OPERATION.
3. REFER TO ELECTRIC AND CONTROL SCHEMATICS, FOR ATTACHMENT OF OTHER CONTROLS.
4. THE MESH SHALL BE POSITIONED SUCH THAT ONLY 3/4" ON CENTER VERTICAL BARS ARE PLACED ON THE RIVER SIDE.
5. STEEL FASTENERS SHALL CONFORM TO ASTM F3125 AND ASTM A325, AND SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION.
6. THE CONNECTOR PLATE DETAILED ON DETAIL A5 SHALL BE FABRICATED AND USED IN LIEU OF THE TROLLEY MANUFACTURER'S CONNECTOR PLATE.
7. CONNECTOR PLATE SHALL BE BOLTED TO THE UPPER FRAMING MEMBER OF THE PANELS.
8. WELDING SCHEME FOR DOUBLE LAYER 4-GAGE WIRE MESH:
   - VERTICAL COMPONENT OF WIRE MESH SHALL BE POSITIONED FACING RIVER SIDE.
   - WIRE MESH LAYERS SHALL BE SPOT-WELDED TO EACH OTHER ON APPROXIMATE 12" CENTERS, OR AS REQUIRED TO PREVENT WARPING.
   - WIRE MESH LAYERS SHALL BE WELDED TOGETHER AND AT THE GATE PANEL PERIMETER ON APPROXIMATE 12" CENTERS, OR AS REQUIRED TO PREVENT WARPING.
   - WIRE MESH SHALL ALSO BE WELDED TO C4X5.4 CROSS-FRAMING AT 12" CENTERS TOP AND BOTTOM OF CHANNEL.
9. INSTALL ONE TROLLEY PER PANEL.

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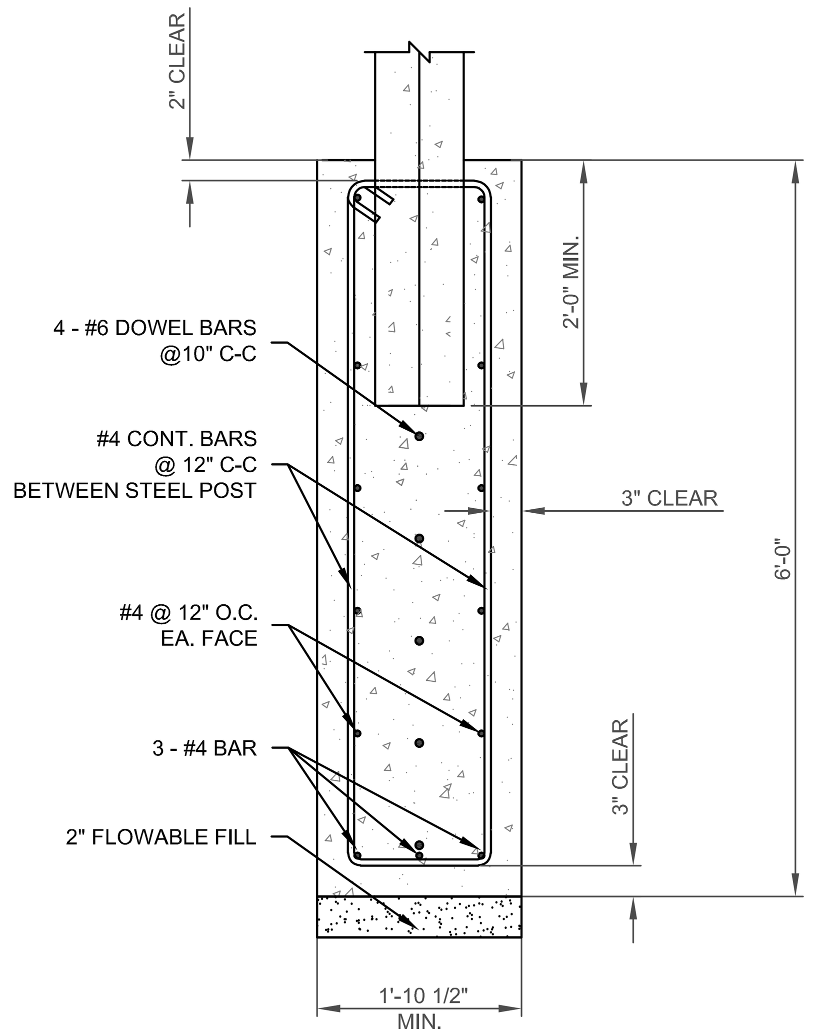
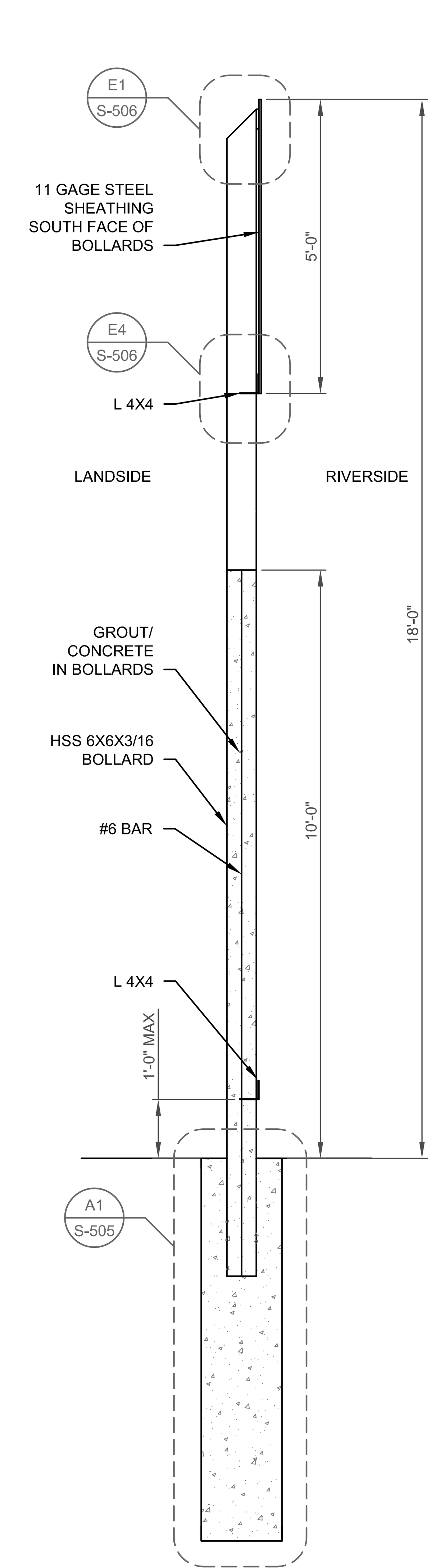
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

WIRE MESH PANEL DETAILS

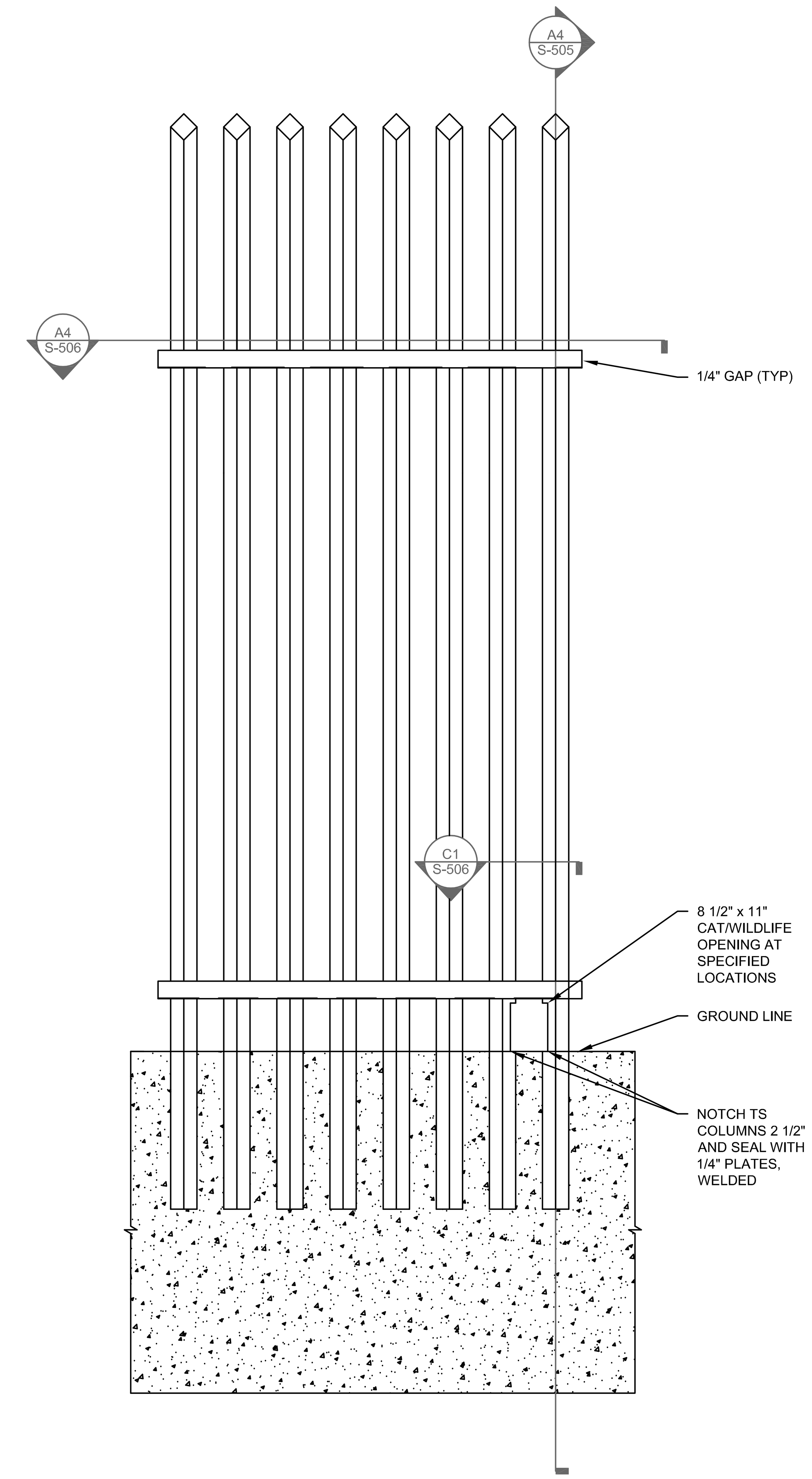
SHEET ID
LAGRULLA
S-504



A1 BOLLARD FENCE FOUNDATION
SCALE: N.T.S.



A4 BOLLARD FENCE SECTION
SCALE: N.T.S.



A7 TYPICAL 8' SECTION BOLLARD FENCE
SCALE: N.T.S.

GENERAL NOTES

1. 6" MIN. CLR. REQUIRED BETWEEN BOTTOM OF HSS & BOTTOM OF FOUNDATION.
2. CONCRETE TO BE 4000 PSI.
3. STEEL BOLLARDS SHALL BE ASTM A500 GRADE B. REFERENCE TECHNICAL SPECIFICATIONS FOR ALL OTHER MATERIAL REQUIREMENTS NOT PROVIDED IN THE DRAWINGS.
4. PLACE A 2" (MIN) FLOWABLE FILL MUD-MAT AFTER EXCAVATION FOR THE BOLLARD FENCE FOUNDATION. MUD MAT TO ACT AS A LEVELING PAD FOR THE FOUNDATION.
5. AT LOCATIONS DIRECTED BY CBP, NOTCH TWO ADJACENT BOLLARDS 2 1/2" TO HEIGHT REQUIRED TO PROVIDE 8 1/2" x 11" CAT OPENING.
6. BOLLARD FILLER FENCE WILL BE SUPPORTED ON A 6-FOOT-DEEP FOUNDATION. THE FINAL REPORT WILL PROVIDE FOOTING BEARING AND SUBGRADE PREPARATION CRITERIA FOR SUPPORT ON STIFF, LEAN AND FAT, CLAYEY NATIVE SOILS, WHICH WILL LIKELY INCLUDE 1) AN ALLOWABLE BEARING PRESSURE OF 2,000 PSF; 2) CLEANING OF LOOSENED OR SLOUGHED SOILS PRIOR TO CONCRETE PLACEMENT; 3) REVIEW OF PREPARED BEARING SURFACES PRIOR TO REINFORCING STEEL AND CONCRETE PLACEMENT; AND 4) PLACEMENT OF A MINIMUM 2" THICK CONCRETE MUD MAT IMMEDIATELY FOLLOWING BEARING SURFACE REVIEW AND PRIOR TO REINFORCING STEEL PLACEMENT IN ORDER TO LIMIT ANY CHANGES IN THE IN-SITU SUBGRADE MOISTURE CONTENT.

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FILE NUMBER:

DESIGNED BY: B.PRESTON
DRAWN BY: B.DUNNE
CHECKED BY: B.PRESTON
SUBMITTED BY: B.PRESTON
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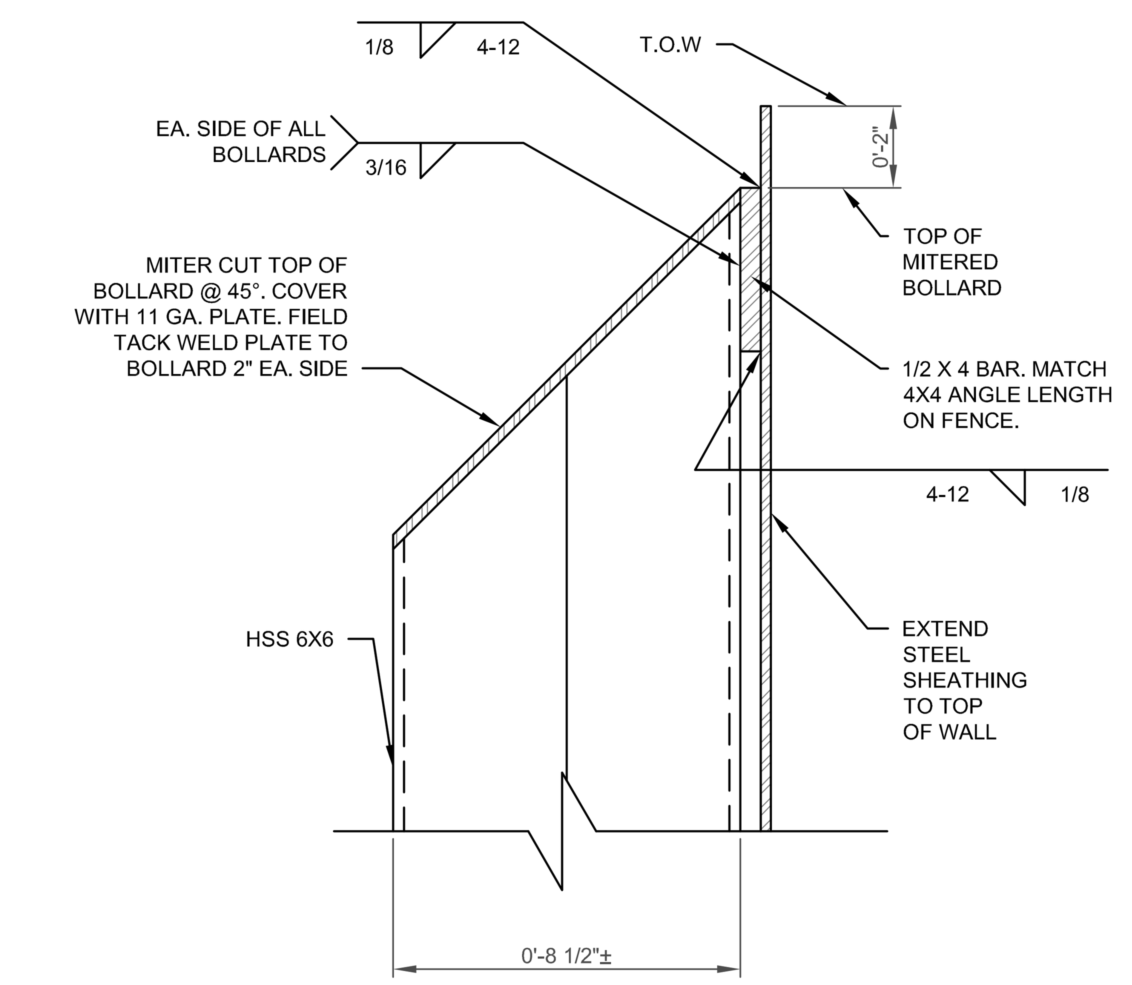
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BOLLARD FENCE

FENCE DETAILS
20 FT. FENCE

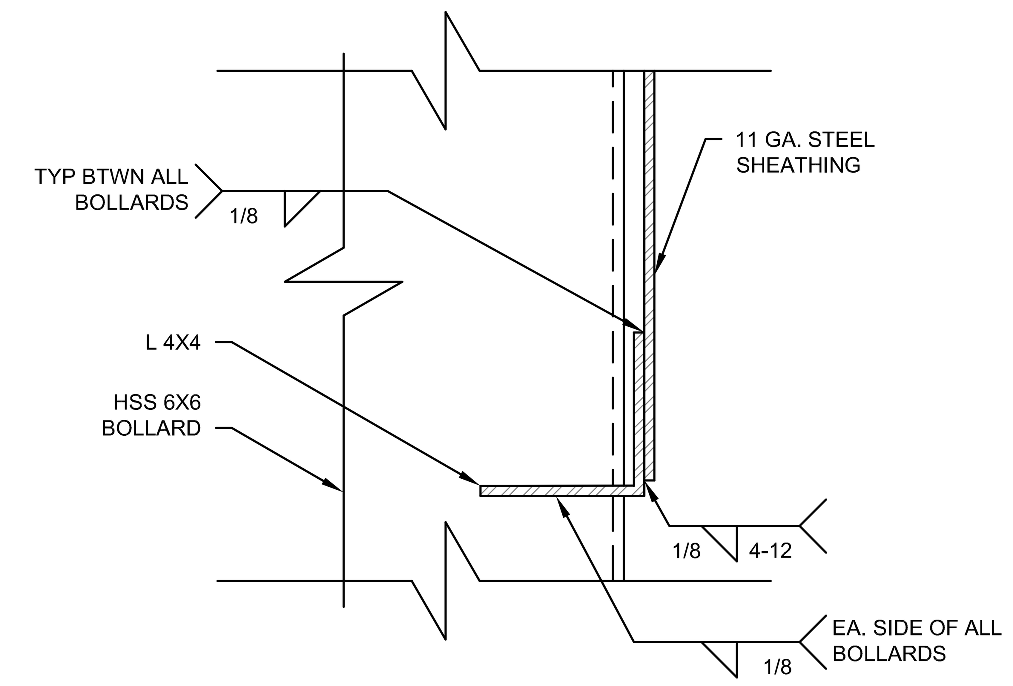
SHEET ID
LAGRULLA
S-505

GENERAL NOTES

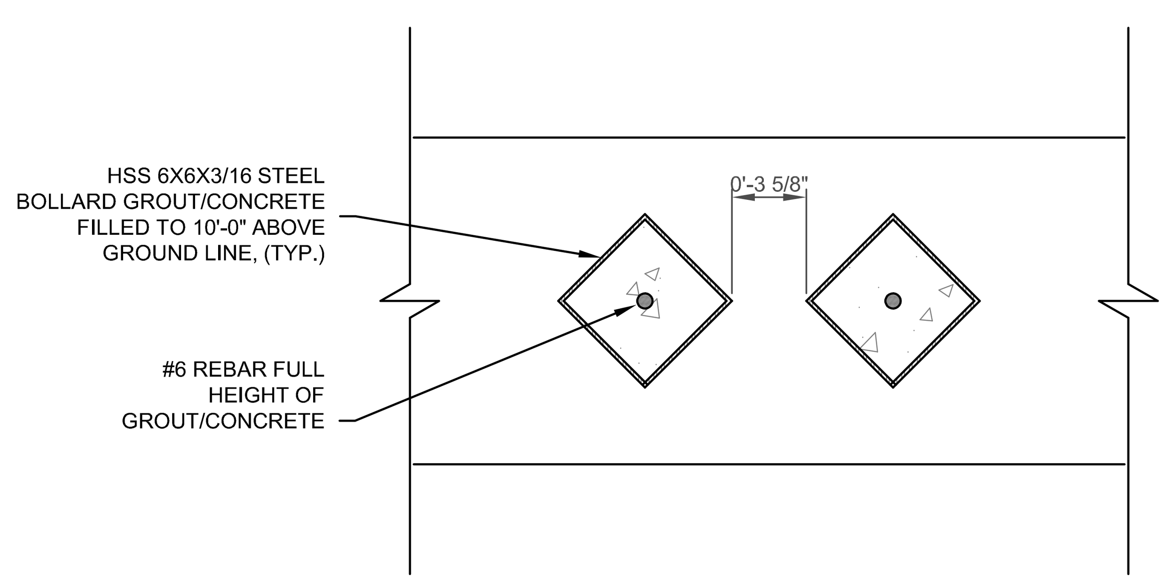
1. 6" MIN. CLR. REQUIRED BETWEEN BOTTOM OF HSS & BOTTOM OF FOUNDATION.
2. CONCRETE TO BE 4000 PSI.
3. STEEL BOLLARDS SHALL BE ASTM A500 GRADE B. REFERENCE TECHNICAL SPECIFICATIONS FOR ALL OTHER MATERIAL REQUIREMENTS NOT PROVIDED IN THE DRAWINGS.



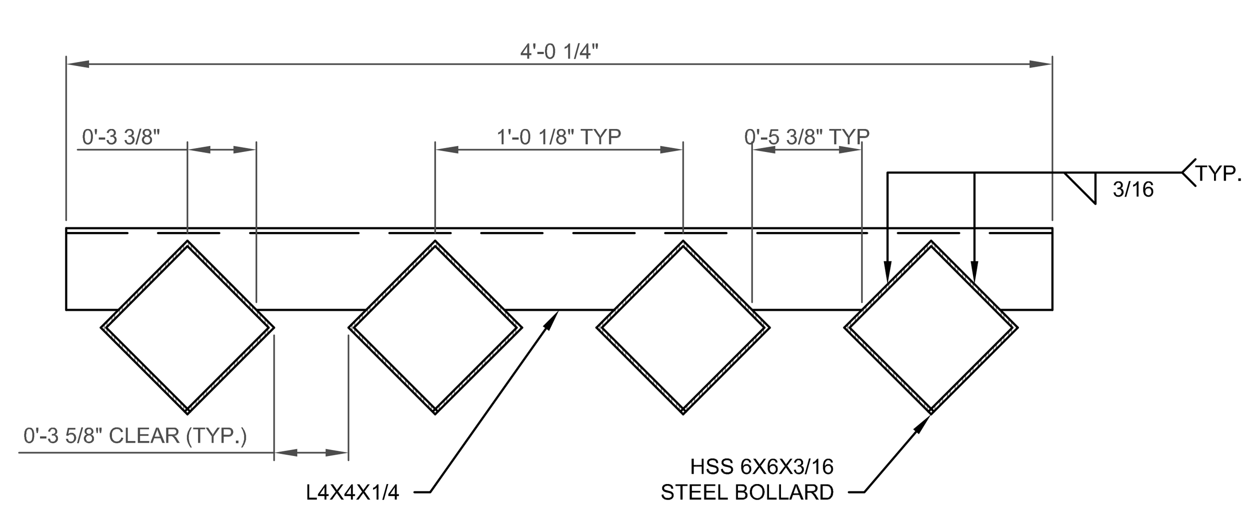
E1 TOP OF FENCE DETAIL
SCALE: N.T.S.



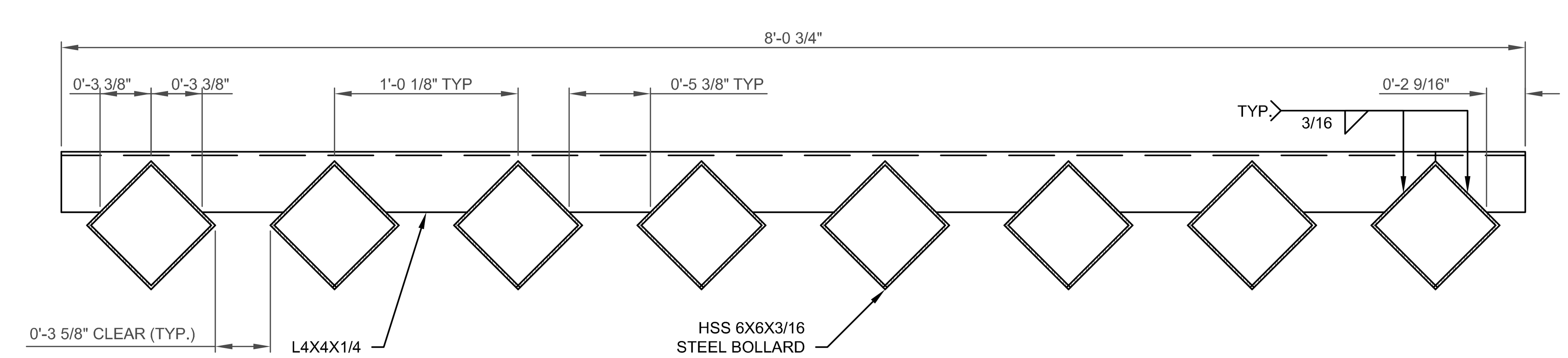
E4 BOTTOM OF SHEATHING DETAIL
SCALE: N.T.S.



C1 BOLLARD FENCE DETAIL
SCALE: N.T.S.



A1 BOLLARD FILLER FENCE
SCALE: N.T.S.



A4 BOLLARD FENCE
SCALE: N.T.S.

XX

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DRAWN BY: B.DUNNE
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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BOLLARD FENCE

FENCE DETAILS
20 FT. FENCE

SHEET ID
LAGRULLA
S-506

ONE-LINE AND RISER

- KVA,CLG / HV-LV / Z — POWER TRANSFORMER
- AMP * — LOW VOLTAGE CIRCUIT BREAKER, DRAWOUT:
  - E.O. = ELECTRICALLY OPERATED
  - G = GROUND
  - I = INSTANTANEOUS
  - IA = INSTANTANEOUS AMPS
  - LT = LONG TIME
  - M.O. = MANUALLY OPERATED
  - ST = SHORT TIME
  - S = SENSOR RATING
- A — MOLDED CASE CIRCUIT BREAKER
- AF — MEDIUM VOLTAGE CIRCUIT BREAKER, DRAWOUT
- MINIATURE CIRCUIT BREAKER
- AMP FUSE — FUSED CUT-OUT SWITCH
- AMP / AMP — FUSED DISCONNECT SWITCH
- AMP — NON-FUSED DISCONNECT SWITCH
- AF / AT / SIZE * — COMBINATION CIRCUIT BREAKER WITH STARTER:
  - FVNR = FULL VOLTAGE NON-REVERSING
  - FVR = FULL VOLTAGE REVERSING
  - 2S = TWO SPEED
  - 1W = ONE WINDING
  - 2W = TWO WINDING
  - C = CONTACTOR
  - SFT = SOFT START
- AMP FUSE — MEDIUM VOLTAGE MOTOR STARTER
- PANELBOARD
- TRANSFER SWITCH (AUTOMATIC OR MANUAL)
- CONVERTER OR VFD (* = ~ = AC, - = DC)
- HP — MOTOR
- GEN — KW / KVA / PF / Z — GENERATOR
- LOCAL CONTROL:
  - CP = CONTROL PANEL
  - HTR = HEATER
  - SKD = SKID MOUNTED LOAD
  - VFD = VARIABLE FREQUENCY DRIVE
  - HOA = HAND/OFF/AUTO
- KV / MCOV — SURGE ARRESTOR
- AMP — FUSE
- BATTERY
- OPEN DELTA
- IMPEDANCE GROUNDED WYE
- GROUND
- DELTA
- SOLID GROUNDED WYE
- MULTIFUNCTION RELAY OR METER (* NOTE 5)
- (QTY) PRI:SEC ACCUR — VOLTAGE TRANSFORMER
- (QTY) PRI/SEC ACCUR — CURRENT TRANSFORMER
  - ■ INDICATES POLARITY
- PRI/SEC ACCUR — CURRENT TRANSFORMER, ZERO SEQUENCE
- WH — WATT HOUR METER

RACEWAY AND LINE TYPES

- CONDUIT STUB WITH CAP
- CONDUIT:
  - EMBEDDED
  - EXPOSED
  - UNDERGROUND DIRECT BURIAL
- C — CONDUIT TURN-DOWN
- O — CONDUIT TURN-UP
- J — JUNCTION BOX
- BUS
- POWER CIRCUIT
- CT & VT CIRCUIT
- CONTROL CIRCUIT
- COMMUNICATION
- ELECTRICAL ENCLOSURE
- E_X — EXISTING OVERHEAD ELECTRICAL LINES
- NEW UNDERGROUND COMMUNICATIONS DUCTBANK
- NEW UNDERGROUND ELECTRICAL DUCTBANK
- INDICATES CABLE NUMBER
- HOME RUN CONDUIT - SHORT STROKES INDICATE PHASE OR SWITCHED WIRES, LONG STROKES INDICATE NEUTRAL, LONG STROKES WITH DOT INDICATE GROUND CONDUCTORS, LONG STROKES WITH TICK INDICATE ISOLATED GROUND

PLAN VIEW

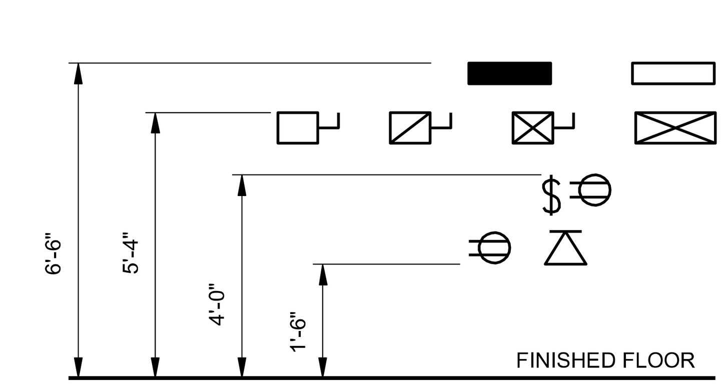
- T — TRANSFORMER
- NON-FUSED DISCONNECT SWITCH
- FUSED DISCONNECT SWITCH
- COMBINATION DISCONNECT WITH STARTER
- $ HP — HORSEPOWER RATED DISCONNECT SWITCH
- PANELBOARD, 480Y/277V OR 480V
- PANELBOARD, 208Y/120V OR 120/240V
- SERVICE ENTRANCE METER
- XFR — TRANSFER SWITCH (AUTOMATIC OR MANUAL)
- M — MOTOR
- GEN — GENERATOR
- LOCAL CONTROL PANEL
- SPECIAL PURPOSE RCPT OR CONNECTION, 480V
- SPECIAL PURPOSE RCPT OR CONNECTION, 240V
- MH — MANHOLE
- HH — HANDHOLE
- SINGLE RECEPTACLE
- DUPLEX RECEPTACLE
- FOURPLEX RECEPTACLE
- J — SURFACE RACEWAY (WIREMOLD)
- COIL

LIGHTING

(SEE NOTE 3)

- LED BOLLARD LIGHT
- HID/INCANDESCENT, WALL MOUNTED
- HID/INCANDESCENT, POLE MOUNTED
- EMERGENCY BATTERY OPERATED UNIT

ELECTRICAL DEVICE MOUNTING HEIGHT



LIGHTING CONTINUED

- EXIT SIGN, SINGLE FACE, CEILING MOUNT
- EXIT SIGN, DOUBLE FACE, CEILING MOUNT
- EXIT SIGN, ARROW INDICATES DIRECTION
- WALL MOUNT
- LIGHTING CONTROL:
  - LC = LIGHTING CONTACTOR
  - OC = OCCUPANCY SENSOR
  - PE = PHOTOELECTRIC CELL
  - TC = TIME CLOCK
  - C = CONTACTOR
  - PSR = PHOTO SENSOR - RECEIVER
  - PST = PHOTO SENSOR - TRANSMITTER
- $ — SWITCH, SINGLE POLE
- $ * — SWITCH:
  - 3 = THREE-WAY
  - 4 = FOUR-WAY
  - D = DIMMER
  - K = KEY OPERATED
  - P = PILOT
  - a,b,c = DENOTES SWITCHING CONTROL
- PS — SAFETY PHOTO SENSOR
- ML — MAGLOCK
- KP — SECURITY KEYPAD

COMMUNICATION

- TEL — TELEPHONE PANEL
- TTB — TELEPHONE TERMINAL BOARD
- AMP — AMPLIFIER
- CCTV SURVEILLANCE CAMERA, FIXED
- CCTV SURVEILLANCE CAMERA, PAN/ZOOM/TILT
- WALL MOUNT

GROUNDING

- GROUND CONDUCTOR
- LIGHTNING PROTECTION CONDUCTOR
- GROUND
- GROUND ROD
- LIGHTNING PROTECTION AIR TERMINAL
- LIGHTNING PROTECTION SPHERE
- THROUGH ROOF TERMINAL
- GROUNDING CONNECTION TO STRUCTURE
- FLUSH GROUND PLATE
- GROUND CONDUCTOR CONNECTION
- GROUNDING PIGTAIL

GENERAL NOTES

1. ALL SYMBOLS AND ABBREVIATIONS SHOWN ON THIS LEGEND MAY NOT APPEAR ON THIS SET OF DRAWINGS.
2. FOR GENERAL LEGEND AND ABBREVIATIONS, SEE "GG" DRAWINGS.
3. X ON FIXTURE SYMBOL DENOTES FIXTURE TYPE DESIGNATION. SEE FIXTURE SCHEDULE.
4. USE DIRECTIONAL ARROW ON EXIT SIGNS AS REQUIRED.
5. IEEE STANDARD C37.2-1991, ELECTRICAL POWER SYSTEM DEVICE FUNCTION NUMBERS.

ELECTRICAL ABBREVIATIONS

NOTE: NOT ALL ABBREVIATIONS INDICTED MAY APPEAR ON THESE DRAWINGS

ABOVE FINISH FLOOR	AFF
ABOVE FINISHED GRADE	AFG
ACCENT	ACC
ADJUSTABLE	ADJ
ALTERNATING CURRENT	AC
ALUMINUM	AL
AMERICAN WIRE GAUGE	AWG
AMMETER	AM
AMPERE	A/AMP
APPROXIMATE(LY)	APPROX
ASYMMETRIC	ASY
AUTOMATIC TRANSFER SWITCH	ATS
BATTERY	BATT
BLACK	BLK
BRACKET	BRKT
BREAKER	BKR
CABINET	CAB
CABLE TELEVISION	CATV
CEILING	CLG
CIRCUIT	CKT
CIRCUIT BREAKER	CKT BKR
CLEAR	CLR
CLOSED CIRCUIT TELEVISION	CCTV
COLUMN	COL
COMMUNICATION	COMM
CONDUIT	C
COOL WHITE	CW
COPPER	CU
CURRENT LIMITING FUSE	CLF
CURRENT TRANSFORMER	CT
DECIBEL	DB
DEDICATED	DED
DIAMETER	DIA
DIRECT CURRENT	DC
DISCONNECT	DISC
DISTRIBUTION PANEL	DP
DOUBLE POLE DOUBLE-THROW	DPDT
DOWNLIGHT	DNLT
DRAWING	DWG
DUAL ELEMENT	DE
EACH	EA
ELECTRIC WATER COOLER	EWC
ELECTRICAL	ELEC
ELECTRICAL CONTRACTOR	EC
ELECTRICALLY OPERATED	ED
ELEVATION	EL
ELEVATOR	ELEV
EMERGENCY LIGHTING	EM
ENERGY SAVING BALLAST	ESB
EQUIPMENT	EQUIP
EXHAUST FAN	EF
EXPLOSION PROOF	XP
FIRE ALARM	FA
FIRE ALARM ANNUNCIATOR PANEL	FAAP
FIRE ALARM CONTROL PANEL	FACP
FIRE ALARM GRAPHIC PANEL	FAGP
FIRE ANNUNCIATOR PANEL	ANNUN
FIXTURE	FIXT
FLOOR	FL
FLUORESCENT	FLUOR
FOOTCANDLES	FC
FULL LOAD AMPERES	FLA
FULL VOLTAGE NON-REVERSING	FVNR
GENERAL CONTRACTOR	GC
GENERATOR	GEN
GROUND	GND/G
GROUND FAULT CIRCUIT INTERRUPTER	GFCI
HAND DRYER	HD
HAND HOLE	HH
HEATING VENTILATING AND AIR CONDITIONING	HVAC
HERTZ	HZ
HIGH INTENSITY DISCHARGE	HID
HIGH POWER FACTOR	HPF
HIGH VOLTAGE	HV
HORSEPOWER	HP
INCANDESCENT	INCAN
ISOLATED GROUND	IG
JUNCTION BOX	JB OR JCT BOX
KILOVAR (REACTANCE)	KVAR
KILOVOLT AMPERE	KVA
KILOWATT	KW
KILOWATT HOUR METER	KWH
LIGHT	LT
LIGHTING	LTG
LIGHTING ARRESTOR	LA
LOW VOLTAGE	LV
MAIN CIRCUIT BREAKER	MCB
MAIN DISTRIBUTION PANEL	MDP
MAIN LUGS ONLY	MLO
MANHOLE	MH
MANUAL TRANSFER SWITCH	MTS
MANUFACTURER	MFR
MASTER ANTENNA TELEVISION	MATV
MECHANICAL CONTRACTOR	MC
MEDIUM VOLTAGE	MV
METAL HALIDE	MH
METAL-CLAD CABLE	MC
MISCELLANEOUS	MISC
MOTOR CIRCUIT PROTECTOR	MCP
MOTOR CONTROL CENTER	MCC
MOTOR OPERATED DAMPER	MOD
MOUNTED	MTD
MOUNTING HEIGHT	MTG HT
NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION	NEMA
NATIONAL ELECTRICAL CODE	NEC
NIGHT LIGHT	NL
NORMALLY CLOSED	NC
NORMALLY OPEN	NO
NOT AVAILABLE/NOT APPLICABLE	N/A
NOT FUSED	NF
NOT IN CONTRACT	NIC
NOT TO SCALE	NTS
ON CENTER	OC
OVERHEAD	OH
OVERLOAD HEATER ELEMENT	OL
PANEL	PNL
PEWTER	PEW
PLYWOOD	PLY
POLE	P
POLYVINYL CHLORIDE	PVC
POTENTIAL TRANSFORMER	PT
POWER PANEL	PP
PULL BOX	PB
RAPID START	RS
RECEPTACLE	REC/RECPT
REFLECTOR	REFL
REQUIRED	REQ'D
RIGID GALVANIZED STEEL CONDUIT	RGS
ROOM	RM
SCHEDULE	SCHED
SINGLE POLE DOUBLE THROW	SPDT
SINGLE POLE SINGLE THROW	SPST
SOLID STATE BALLAST	SSB
SURGE PROTECTION DEVICE	SPD
SWITCH	SW
SWITCHBOARD	SWBD
SWITCHGEAR	SWGR
TELEPHONE	TEL
TRANSFORMER	XFMR
TRANSIENT VOLTAGE SURGE SUPPRESSOR	TVSS
TWIN TUBE	TT
TYPICAL	TYP
UNDERGROUND	UG
UNDERWRITERS' LABORATORIES	UL
UNINTERRUPTIBLE POWER SUPPLY	UPS
UNLESS OTHERWISE NOTED	UON
VAPOR PROOF	VP
VOLT	V
VOLTMETER	VM
WARM WHITE	WW
WATT	W
WEATHERPROOF	WP
WITH	W/
WITHIN	W/I
WITHOUT	W/O

US Army Corps of Engineers ®

DATE | DESCRIPTION | MARK

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DESIGNED BY: M.J. HILL | DRAWN BY: D.A. NELSON | CHECKED BY: | SUBMITTED BY: | SIZE: ANSI D

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RGV 06 - BORDER INFRASTRUCTURE CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE
LEGEND AND ABBREVIATIONS

SHEET ID
LAGRULLA
E-001

LIGHTING GENERAL NOTES

1. THESE PLANS ARE INTENDED TO DEPICT THE LIGHT FIXTURE POLE LAYOUT, CIRCUITING REQUIREMENTS, PHOTOMETRIC REQUIREMENTS, AND OTHER GENERAL REQUIREMENTS FOR THE LIGHT FIXTURES TO BE USED.
2. THE INTENT OF THE LIGHTING DESIGN IS A PERFORMANCE SPECIFICATION, DESIGNED TO GIVE SPECIFIC REQUIREMENTS FOR THE PERFORMANCE OF THE LIGHT FIXTURES. REFERENCE SPECIFICATIONS FOR ALL REQUIREMENTS. ANY MANUFACTURER MEETING ALL REQUIREMENTS WILL BE CONSIDERED ACCEPTABLE.
3. THE LIGHT FIXTURES FOR GENERAL ENFORCEMENT ZONE ILLUMINATION MUST MEET THE FOLLOWING PHOTOMETRIC REQUIREMENTS WITHIN THE ENFORCEMENT ZONE, AT THE LIGHT POLE HEIGHTS AND SPACING INDICATED ON THE PLANS (IN ADDITION TO OTHER REQUIREMENTS ON THE PLANS AND SPECIFICATIONS):
   - AVERAGE OF 3 HORIZONTAL FOOTCANDLES AT GRADE ACROSS THE ENTIRE ENFORCEMENT ZONE BOUNDARY INDICATED ON THE PLANS, WHICH RANGES FROM 50-150 FEET FROM THE BORDER FENCE AS SHOWN ON THE PLANS.
   - -MAXIMUM TO MINIMUM FOOTCANDLE RATIO OF 20 TO 1 WITHIN THE ENFORCEMENT ZONE.
   - -LIGHT TRESPASS BEYOND THE ENFORCEMENT ZONE SHALL BE LIMITED TO 0.5 FOOTCANDLES, AND SHALL TAPER TO BELOW 0.1 FOOTCANDLES AT A MAXIMUM OF 75 FEET BEYOND THE ENFORCEMENT ZONE BOUNDARY.
4. THE LIGHT FIXTURES AT THE VEHICULAR GATES MUST MEET THE FOLLOWING PHOTOMETRIC REQUIREMENTS WITHIN THE GATE AREAS, AT THE MOUNTING HEIGHT AND LOCATIONS INDICATED ON THE PLANS (IN ADDITION TO OTHER REQUIREMENTS ON THE PLANS AND SPECIFICATIONS):
   - ILLUMINATE A PERIMETER OF 100 FEET BY 100 FEET, CENTERED ON THE MIDDLE OF THE GATE TO A MINIMUM OF 2 FOOT CANDLES AT THE GROUND LEVEL.

MEDIA CONVERTER GENERAL NOTES

1. MEDIA CONVERTER SHALL BE CAPABLE OF (2) INDEPENDENT FIBER OPTIC INPUTS AND (1) PoE COPPER CABLING OUTPUT. MEDIA CONVERTER SHALL AUTOMATICALLY TRANSFER BETWEEN FIBER OPTIC INPUTS AS AVAILABLE.
2. MEDIA CONVERTERS SHALL BE POWERED UTILIZING STANDARD 110V ELECTRICAL OUTLET.

GROUNDING GENERAL NOTES

1. FENCE GROUNDING, WHERE INDICATED ON THE PLANS, SHALL CONSIST OF 3/4" X 10' GROUND ROD PER SPECIFICATIONS, WITH THE TOP OF GROUND ROD A DRIVEN A MINIMUM OF 6" BELOW THE TOP OF FINISHED GRADE. CONNECT AND BOND #6 CONDUCTOR FROM GROUND ROD TO FENCE BOLLARD AT LOCATIONS INDICATED ON PLANS. ENSURE THAT BOLLARD FENCING IS ELECTRICALLY CONTINUOUS THROUGH EITHER WELDED PLATE OR CONCRETE ENCASED REINFORCING STEEL.
2. ALL GROUNDING SHALL BE IN STRICT COMPLIANCE WITH ARTICLE 250 OF THE 2017 NATIONAL ELECTRICAL CODE.

TRANSFER SWITCH GENERAL NOTES

1. MANUAL TRANSFER SWITCHES LOCATED AT THE VEHICLE GATES AND UTILITY CONNECTION POWER DISTRIBUTION POINTS SHALL INCLUDE CAM-LOCK STYLE CONNECTORS FOR QUICK CONNECTION OF PORTABLE GENERATORS.

CAMERA INFRASTRUCTURE NOTES

1. THE INTENT OF THIS PROJECT IS TO INCLUDE THE NECESSARY INFRASTRUCTURE FOR FUTURE SECURITY CAMERA CONNECTIONS AT LIGHT POLES ALONG THE ENFORCEMENT ZONE BOUNDARY. CAMERAS, CAMERA MOUNTS, AND COPPER CABLING TO THE POLE MOUNTED CAMERAS FROM THE CAMERA BOXES AT THE BASE OF THE LIGHT POLES WILL BE PROVIDED AND INSTALLED BY OTHERS AS PART OF A FUTURE PROJECT. THIS PROJECT INCLUDES ONLY THE CONDUIT INFRASTRUCTURE TO THE LIGHT POLES, THE CAMERA BOXES AS DETAILED AT EVERY 6TH LIGHT POLE, AND THE MEDIA CONVERTERS WITHIN THE CAMERA BOXES.

MINI-POWER CENTER GENERAL NOTES

1. EACH MINI-POWER CENTER AS INDICATED ON THESE PLANS SHALL BE ENCLOSED IN A WEATHERPROOF NEMA 4X ENCLOSURE, AND SHALL STEP THE VOLTAGE DOWN FROM 480V TO 120/240V, SINGLE PHASE. EACH MINI-POWER CENTER SHALL HAVE A MINIMUM INTEGRATED 3KVA TRANSFORMER WITHIN THE ENCLOSURE, AS WELL AS TRANSFORMER PRIMARY CIRCUIT BREAKER AND (8) 20A/1P SECONDARY CIRCUIT BREAKERS, FOR 120V FEEDERS TO CAMERA MEDIA CONVERTER ENCLOSURES.

GATE GENERAL NOTES

1. PROVIDE COMMUNICATIONS AND ELECTRICAL HANDHOLE AT EACH GATE.
2. PROVIDE COMMUNICATIONS, POWER, AND CONTROLS AT EACH GATE PER DRAWINGS E-503 AND E-603

ELECTRICAL GENERAL NOTES

1. THESE PLANS ARE SCHEMATIC. THE CONTRACT DOCUMENTS CREATED BY THIS OFFICE ARE DIAGRAMMATIC AND SHOW THE INTENTION OF THIS PROJECT TO INSTALL NEW EQUIPMENT AND ASSOCIATED MATERIALS. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS PRIOR TO BID.
2. ALL ELECTRICAL WORK IS REQUIRED TO BE PERFORMED BY A CERTIFIED ELECTRICAL CONTRACTOR. ALL WIRING, EQUIPMENT, DEVICES AND INSTALLATIONS SHALL CONFORM TO ALL APPLICABLE LOCAL, STATE AND FEDERAL CODES.
3. PROVIDE ALL WIRING, CONDUIT, LABOR AND MATERIALS NOT SHOWN ON PLAN, BUT NECESSARY FOR COMPLETE AND PROPER OPERATION OF THE ELECTRICAL SYSTEM.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL FEES AND PERMITS AS NECESSARY TO COMPLETE THIS JOB. CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS AND EQUIPMENT NECESSARY TO ENSURE A COMPLETE WORKING SYSTEM.
5. ALL ELECTRICAL WORK MUST COMPLY WITH THE REQUIREMENTS OF NFPA 70 (NATIONAL ELECTRICAL CODE), NFPA 70B, NFPA 70E, IECC, OSHA IN ADDITION TO OTHER REFERENCES REQUIRED BY CONTRACT.
6. INSTALLATION OF SWITCHES, OUTLETS AND CONTROL DEVICES SHALL COMPLY WITH LOCAL CODES AND STATE ADA REQUIREMENTS.
7. REFER TO CIVIL PLANS FOR EXACT LOCATIONS OF ALL EQUIPMENT.
8. ALL ELECTRICAL EQUIPMENT, DEVICES AND CIRCUITS SHALL CONTAIN A GROUNDING CONDUCTOR. CONDUIT SYSTEM SHALL NOT BE USED AS GROUNDING NETWORK. ALL GROUNDING SHALL BE IN STRICT COMPLIANCE WITH ARTICLE 250 OF THE NATIONAL ELECTRICAL CODE.
9. COORDINATE LOCATION AND VERIFY REQUIREMENTS OF ALL EXTERIOR UTILITY EQUIPMENT AND METER BASE WITH OWNER AND UTILITY COMPANY. UTILITY PROVIDER FOR THE PROJECT IS A.E.P. CONTRACTOR RESPONSIBLE FOR PROVIDING UTILITY SERVICE PROVIDER WITH LOAD FORMS AND ALL INFORMATION REQUIRED FOR NEW SERVICE INSTALLATION PER UTILITY COMPANY STANDARDS. COORDINATE WITH UTILITY COMPANY FOR EXACT SERVICE POINT, POLE, AND TRANSFORMER LOCATIONS.
10. UTILITY SECONDARY TRENCH AND CONDUIT REQUIREMENTS SHALL BE IN ACCORDANCE WITH THE UTILITY COMPANY SPECIFICATIONS. COORDINATE WITH UTILITY COMPANY. PROVIDE AND INSTALL ALL MATERIAL AND EQUIPMENT AS REQUIRED FOR COMPLETE JOB INSTALLATION.
11. ALL SWITCHBOARDS, PANELBOARDS, TRANSFORMERS, DISCONNECT SWITCHES AND OTHER ELECTRICAL DEVICES AND EQUIPMENT SHALL HAVE ENGRAVED NAMEPLATES INDICATING EQUIPMENT IDENTIFICATION TAG AND VOLTAGE, AS WELL AS WHERE DEVICE IS FED FROM. ALL SWITCHBOARDS AND PANELBOARDS SHALL HAVE TYPED DIRECTORIES INDICATING DISTRIBUTION AND BRANCH CIRCUIT FEEDERS.
12. CONTRACTOR IS RESPONSIBLE FOR NATIONAL ELECTRICAL CODE REQUIRED CLEARANCES AROUND AND ABOVE ALL ELECTRICAL EQUIPMENT AND DEVICES.
13. SHORT CIRCUIT AMPERE INTERRUPTING CAPACITY (A.I.C.) RATING OF ALL ELECTRICAL PRODUCTS SHALL BE GREATER THAN THE MAXIMUM AVAILABLE SHORT CIRCUIT CURRENT.
14. WIRE AND CONDUIT SIZES SHALL BE INSTALLED AND SIZED TO COMPENSATE FOR VOLTAGE DROP PER THE NATIONAL ELECTRICAL CODE.
15. ALL ELECTRICAL AND ELECTRONIC COMPONENTS EXPOSED TO WEATHER SHALL BE RATED AT NEMA 4X; INCLUDING, BUT NOT LIMITED TO: DISTRIBUTION PANELS, JUNCTION BOXES, RECEPTACLES, OUTLETS, PERIPHERALS, SENSORS, TRANSMITTERS, KEYPADS, AND THE FASTENERS USED/CONNECTIONS MADE THEREFORE.
16. ALL LIGHT POLE AND RVSS TOWER HAND HOLES AND ACCESS PANELS BELOW 20'-0" ABOVE GROUND SHALL EMPLOY PROPRIETARY GEOMETRY, HIGH LEVEL SECURITY, TAMPER-PROOF FASTENERS THAT WILL NOT PROMOTE DISSIMILAR METALS CORROSION.

RVSS TOWER GROUNDING GENERAL NOTES

1. AS PART OF THE WORK, THE CONTRACTOR WILL BE RESPONSIBLE FOR PROVIDING AND INSTALLING A EARTH ELECTRODE SYSTEM (EES) AT THE BASE OF EACH OF THE RVSS TOWER LOCATIONS INDICATED ON THE PLANS. EES SHALL BE UTILIZED FOR FUTURE CONNECTION OF TOWER GROUNDING, TOWER LIGHTNING PROTECTION, ELECTRICAL/FIBER EQUIPMENT AND ENCLOSURE GROUNDING, FENCING / BOLLARDS, AND RVSS UPS EQUIPMENT GROUNDING. FINAL CONNECTIONS TO FUTURE OR OWNER PROVIDED EQUIPMENT NOT INDICATED TO BE INSTALLED ON THESE PLANS SHALL BE BY OTHERS.
2. ALL GROUNDING AT RVSS TOWERS SHALL CONFORM TO FAA-STD-019E AS A MINIMUM.
3. GROUNDING ELECTRODE SYSTEM SHALL BE USED FOR LIGHTNING PROTECTION OF THE FUTURE RVSS TOWER, AND AS SUCH, SYSTEM SHALL BE INSTALLED AND LABELED IN ACCORDANCE WITH ALL UL 96A AND NFPA 780 REQUIREMENTS.
4. SITE SURVEY: A SITE SURVEY SHALL BE CONDUCTED BY THE CONTRACTOR FOR BOTH RVSS SITES INDICATED ON THESE PLANS TO DETERMINE THE GEOLOGICAL AND OTHER PHYSICAL CHARACTERISTICS OF THE SURROUNDING EARTH. INFORMATION TO BE COLLECTED SHALL INCLUDE LOCATION OF ROCK FORMATIONS, GRAVEL DEPOSITS, SOIL TYPES ETC. PERFORM A SOIL RESISTIVITY TEST AT PROBE SPACINGS OF 10, 20, 30 AND 40 FEET IN FOUR DIRECTIONS FROM THE PROPOSED RVSS TOWER AND EQUIPMENT. ALL SURVEY DATA, INCLUDING SOIL RESISTIVITY MEASUREMENTS, SHALL BE NOTED ON A SCALED DRAWING OR SKETCH OF THE SITE AND SUBMITTED TO THE ENGINEER FOR REVIEW.
5. SHOP DRAWINGS: CONTRACTOR SHALL PROVIDE SHOP DRAWINGS OF THE PROPOSED EES TO THE ENGINEER FOR REVIEW AND APPROVAL, INDICATING LOCATIONS OF ALL GROUNDING ELECTRODES, GROUNDING CONDUCTORS, AND OTHER GROUNDING ACCESSORIES AS REQUIRED. THE EES SHALL CONSIST OF AT LEAST (4) DRIVEN GROUND RODS (CONFIGURATION AND DEPTH BASED ON SOIL TEST), SUPPLEMENTAL GROUNDING ELECTRODES (IF REQUIRED), AND BURIED INTERCONNECTING CONDUCTORS. THE SITE SURVEY INFORMATION SHALL BE USED AS THE BASIS FOR THE DESIGN OF THE EES. THE RESISTANCE TO EARTH OF THE EES SHALL BE NOT OVER 10 OHMS. WHERE CONDITIONS ARE ENCOUNTERED SUCH AS ROCK NEAR THE SURFACE, SHALLOW SOILS, PERMAFROST AND SOILS WITH LOW MOISTURE OR MINERAL CONTENT, A SUPPLEMENTAL GROUNDING ELECTRODE MAY BE REQUIRED TO BE USED.
6. SUPPLEMENTAL GROUNDING ELECTRODES: GROUND DISSIPATION PLATES MAY BE USED. IN SHALLOW SOIL LOCATIONS WITH LIMITED SURFACE SPACE, GROUND DISSIPATION PLATES SHALL BE ALLOWED IN PLACE OF GROUND RODS IN THE EARTH ELECTRODE SYSTEM (EES). THE PLATES SHALL BE INSTALLED AT THE CORNERS OF THE EES AT THE FARTHEST ACCESSIBLE POINT FROM THE RVSS TOWER. PLATES SHALL BE CONSTRUCTED OF A MINIMUM ONE QUARTER-INCH THICK COPPER AND BE A MINIMUM OF TWO FEET SQUARE. THESE PLATES SHOULD BE INSTALLED IN A VERTICAL PLANE TO TAKE ADVANTAGE OF SEASONAL MOISTURE AND TEMPERATURE CHANGES IN THE SOIL. INSTALL THE PLATES AT THE SAME DEPTH OR DEEPER THAN THE INTERCONNECTING CONDUCTOR, BUT MAINTAIN A MINIMUM OF ONE-FOOT OF NATIVE SOIL ABOVE THE UPPER EDGE OF THE PLATE. ATTACHMENT TO THE EES SHALL BE WITH A 4/0 AWG BARE STRANDED COPPER CONDUCTOR, EXOTHERMICALLY WELDED TO THE EES AND THE PLATE. THE ATTACHMENT POINT AT THE PLATE SHALL BE AT THE CENTER OF THE PLATE, NOT NEAR THE EDGE OR THE CORNERS. THEY SHALL BE CONFIGURED AS A JORDAN DISSIPATION PLATE DESIGN OR EQUAL.
7. INTERCONNECTIONS: GROUND RODS AND GROUNDING ELECTRODES OF THE EES SHALL BE INTERCONNECTED BY A BURIED, BARE, 4/0 AWG COPPER CONDUCTOR. THE CONDUCTOR SHALL BE BURIED AT 30" BELOW GRADE LEVEL. CONNECTIONS TO THE GROUNDING ELECTRODES SHALL BE EXOTHERMICALLY WELDED. THE INTERCONNECTING CONDUCTOR SHALL CLOSE ON ITSELF FORMING A COMPLETE LOOP WITH THE ENDS EXOTHERMICALLY WELDED. THE BONDING RESISTANCE OF ALL INTERCONNECTIONS SHALL BE ONE MILLIOHM OR LESS FOR EACH BOND WHEN MEASURED WITH A 4-TERMINAL MILLIOHM METER.
8. A MINIMUM OF ONE ACCESS WELL SHALL BE INSTALLED FOR THE EES. THE WELL SHOULD BE LOCATED AT A GROUND ROD THAT IS IN AN AREA WITH ACCESS TO THE OPEN SOIL, SO THAT CHECKS OF THE EES CAN BE MADE ONCE THE FACILITY IS IN USE. THE ACCESS WELL SHALL BE MADE FROM CLAY PIPE, POURED CONCRETE, OR OTHER APPROVED WALL MATERIAL AND SHALL HAVE A REMOVABLE COVER. THE ACCESS WELL SHALL BE CONSTRUCTED TO PROVIDE A MINIMUM CLEARANCE (12 INCHES RADIUS) FROM THE CENTER OF THE GROUND ROD TO THE INSIDE WALL OF THE ACCESS WELL. THE ACCESS WELL SHALL HAVE AN OPENING OF A MINIMUM 12 INCH RADIUS. CONNECTIONS SHALL BE BY EXOTHERMIC WELDS.
9. CONTRACTOR SHALL STAKE OUT THE EXACT LOCATION OF THE BURIED GROUND LOOP CONDUCTOR IN THE FIELD AFTER INSTALLATION, SO THAT IT CAN BE TIED INTO WITH EQUIPMENT AND TOWER GROUND CONDUCTORS BY OTHERS WITH MINIMUM EXCAVATION.
10. GROUND RODS SHALL BE COPPER CLAD STEEL, MINIMUM 10 FEET IN LENGTH AND 3/4" IN DIAMETER. ROD CLADDING SHALL NOT BE LESS THAN 1/100" THICK. GROUND RODS SHALL BE AS WIDELY SPACED AS POSSIBLE, AND IN NO CASE SPACED LESS THAN ONE ROD LENGTH. TOPS OF GROUND RODS SHALL BE NOT LESS THAN 6 INCHES BELOW GRADE LEVEL.
11. GROUND LOOP CONDUCTOR TRENCH SHALL BE EXCAVATED TO 36" BELOW GRADE. CONDUCTOR SHALL BE INSTALLED AT 30" BELOW GRADE. BOTTOM 12" OF TRENCH SHALL BE BACKFILLED WITH BENTONITE/EARTH MIX BACKFILL. REMAINDER OF TRENCH SHALL BE BACKFILLED WITH COMPACTED BACKFILL.
12. CONTRACTOR SHALL PROVIDE AND INSTALL A 24" X 2" X 1/4" COPPER GROUND BAR ON THE INTERIOR WALL OF THE RVSS TOWER EQUIPMENT SHELTER, WITH ISOLATORS AND PRE-DRILLED GROUNDING HOLES. CONNECT GROUND BAR WITH 4/0 AWG GROUND CONDUCTOR TO GROUND LOOP. GROUND BAR SHALL BE USED FOR PANEL/TRANSFORMER/EQUIPMENT GROUNDING CONNECTIONS PER CODE REQUIREMENTS WITHIN EQUIPMENT SHELTER.
13. THE GROUNDING SYSTEM SHALL BE CONSTRUCTED IN ACCORDANCE WITH UL 96 AND NFPA 780 REQUIREMENTS. CERTIFICATION SHALL BE PERFORMED BY AN INDEPENDENT, THIRD-PARTY INSPECTION FIRM. THE INSPECTION FIRM CANNOT BE THE SYSTEM DESIGNER OR INSTALLER.

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

DESIGNED BY: M.J. HILL
DRAWN BY: D.A. NELSON
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SUBMITTED BY:
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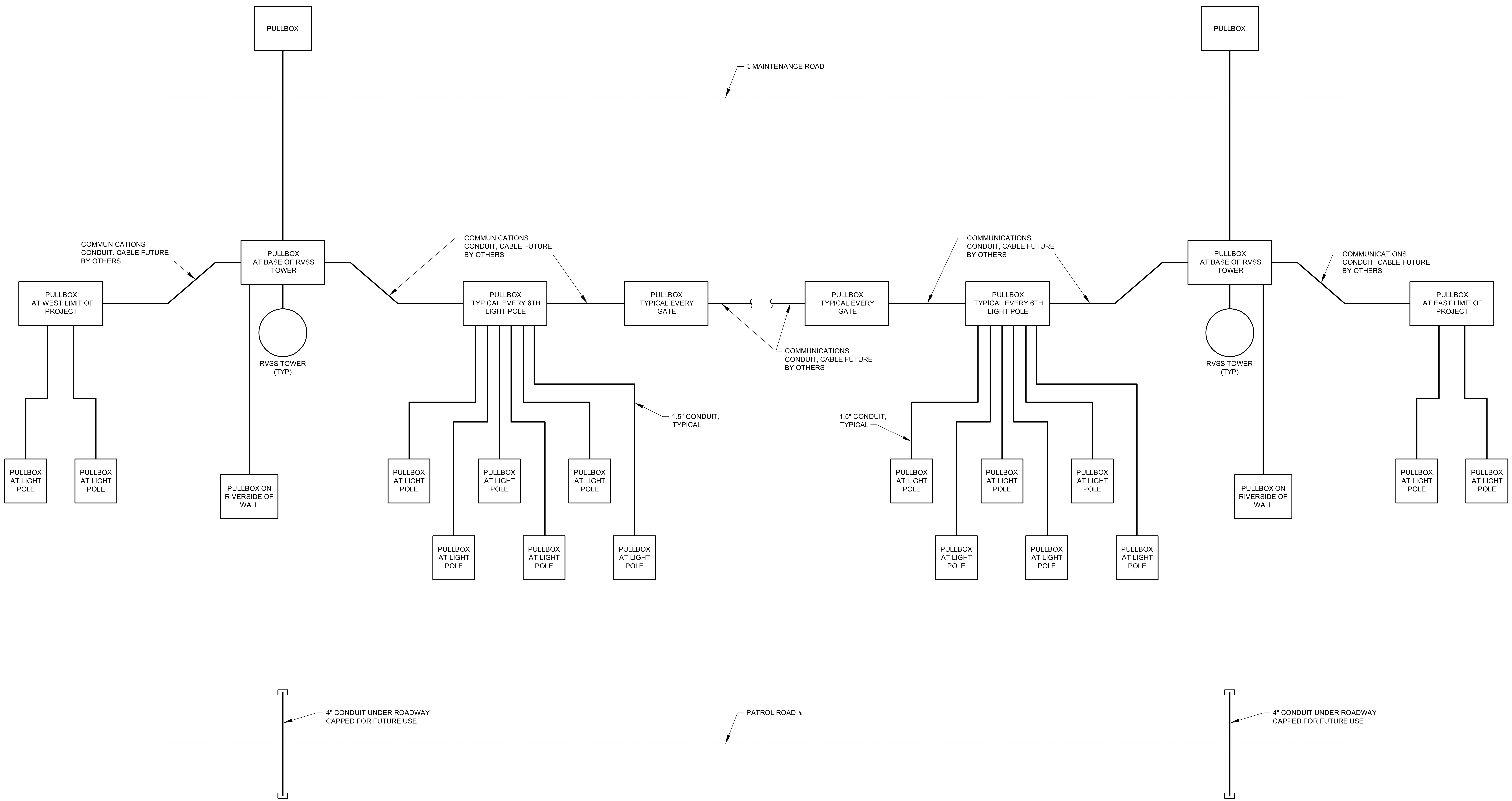
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE
ELECTRICAL AND COMMUNICATION NOTES

SHEET ID
LAGRULLA
E-002

NOTES:

1. DUCTBANK AND QUANTITY AND SIZE OF CONDUITS BY CONTRACTOR TO BE COORDINATED WITH OWNER.



CONCEPTUAL OVERALL COMMUNICATIONS CONDUIT INFRASTRUCTURE

NO SCALE

US Army Corps of Engineers ®

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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE
CONCEPTUAL OVERALL CAMERA CONDUIT INFRASTRUCTURE

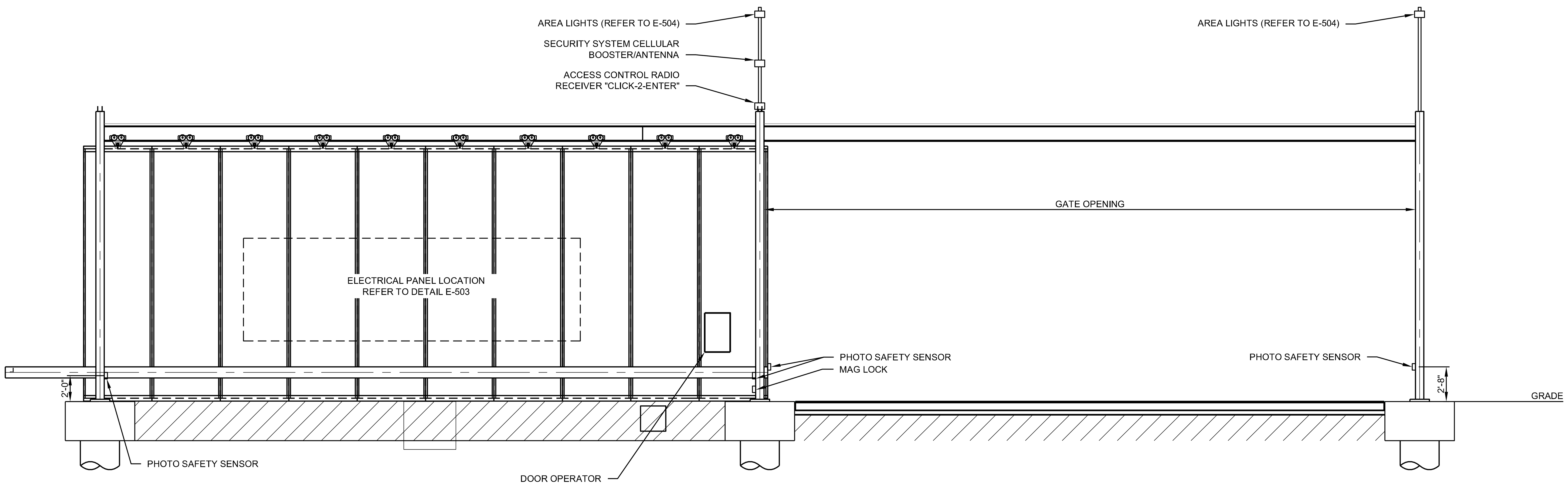
SHEET ID
LAGRULLA
E-101

GENERAL NOTES

1. RATING OF THE MANUAL TRANSFER SWITCH'S TRANSFER PANEL "QUICK COUPLING" SHALL BE COORDINATED WITH THE SIZE OF THE ANTICIPATED MOBILE EMERGENCY GENERATOR.
2. KEYPADS MAY NEED TO BE RE-LOCATED TO REFLECT ACTUAL SITE CONDITIONS.
3. MAGLOCK SHALL BE PLACED UNDER GATE OPERATOR.
4. UNLESS NOTED OTHERWISE, RUN UNDERGROUND CONDUITS LOCATED ALONG AND IN THE VICINITY OF THE GATE OPENING UNDER THE 4' WIDE x 8" DEEP GATE OPENING CONCRETE SLAB.

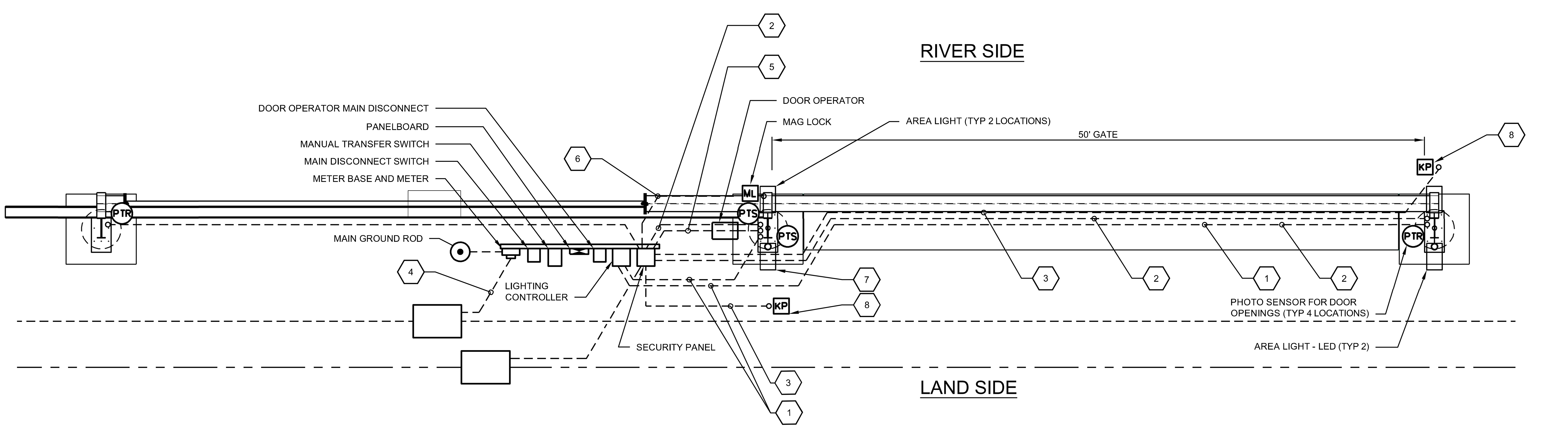
XX KEYED NOTES

1. POWER FOR AREA LIGHTS - 1" SCHEDULE 80 - TO LIGHTING CONTACTOR.
2. CONDUIT FOR PHOTO SAFETY SENSOR - 1" SCHEDULE 80 - TO SECURITY.
3. CONDUIT FOR SECURITY KEYPAD - 1" SCHEDULE 80.
4. CONDUIT FOR CONNECTION TO RGV-06 POWER DUCTBANK SCHEDULE 80.
5. CONDUIT FOR "CLICK-TO-ENTER" AND CELLULAR ANTENNA SYSTEM - 1" SCHEDULE 80.
6. CONDUIT FOR MAGNETIC LOCK - 1" SCHEDULE 80.
7. FIXTURE IDENTIFIED SHALL BE CONNECTED TO BATTERY CIRCUIT. SEE DETAIL E-605.
8. PROVIDE GOOSENECK MOUNTING ARM AND CONCRETE BASE FOR MOUNTING OF KEYPAD. SEE CIVIL PLANS FOR EXACT LOCATION OF KEYPADS.



GATE PHOTOELECTRIC BEAM DEVICES MOUNTING HEIGHTS

SCALE: 3/16" = 1'-0"



GATE ELECTRICAL LAYOUT - RIGHT SIDE LAYOUT

SCALE: 3/16" = 1'-0"

AT FULL SIZE
0 1 2 3 IN
0 1 2 3 4 5 6 7 8 cm

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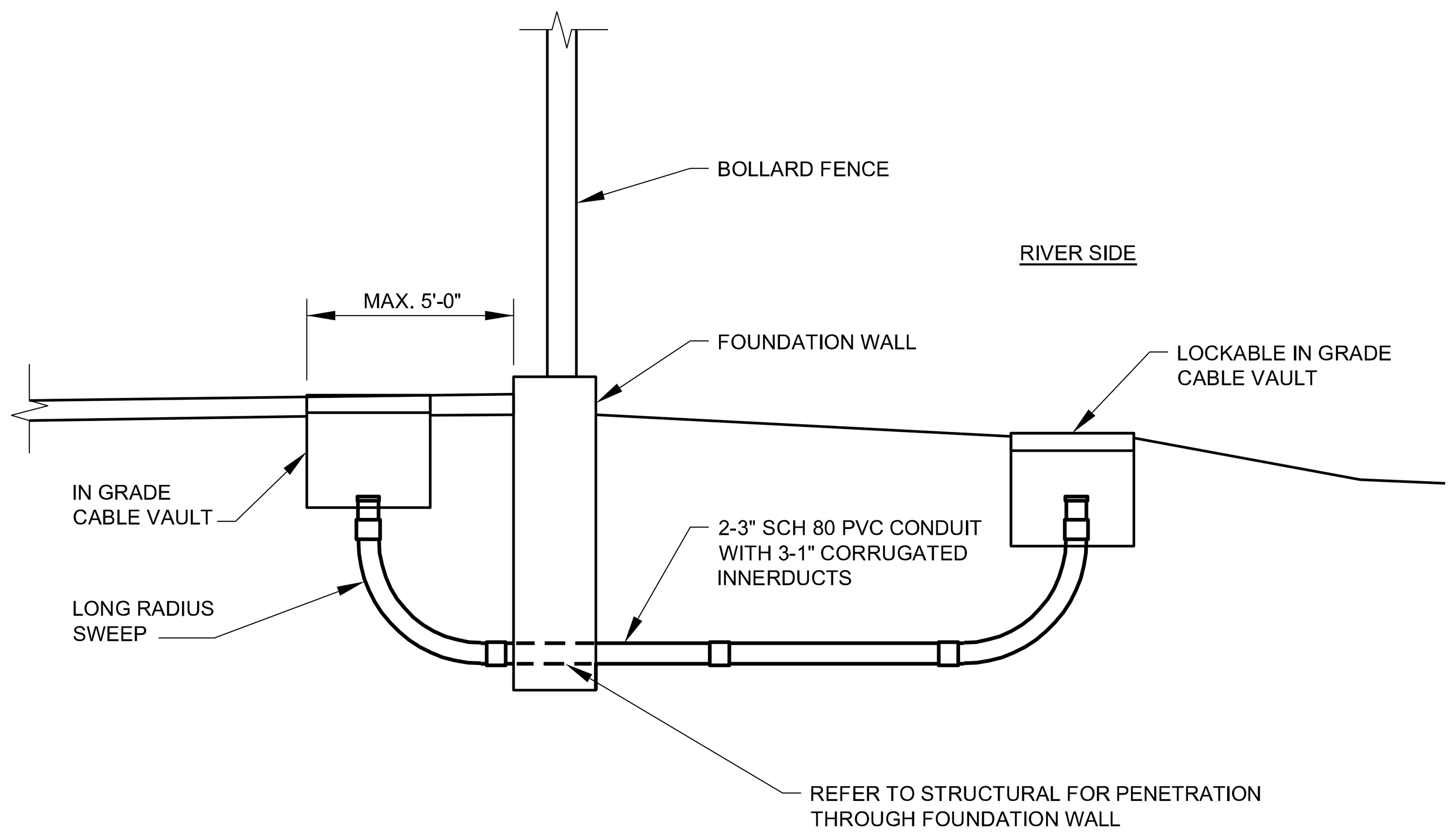
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE
ELECTRICAL SINGLE GATE - PLAN VIEW
50 FEET SINGLE LEAF AUTOMATED GATE

SHEET ID
LAGRULLA
E-102



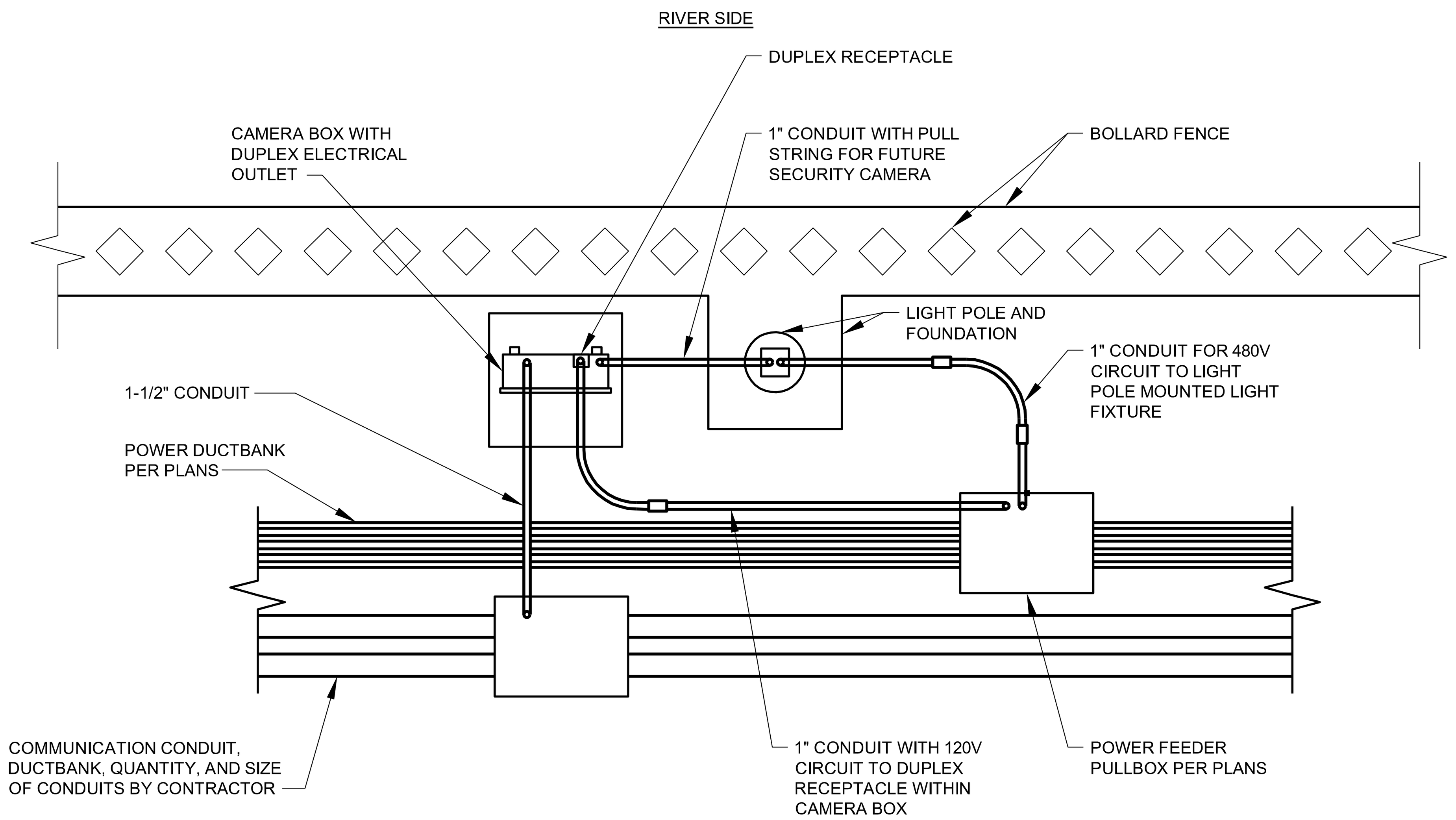
SECTION

NOTES:

1. IN ADDITION TO PENETRATIONS FOR RVSS TOWERS PROVIDE AT BEGINNING AND END OF EACH CONTRACT WALL SEGMENT FOR FUTURE CONNECTIONS.

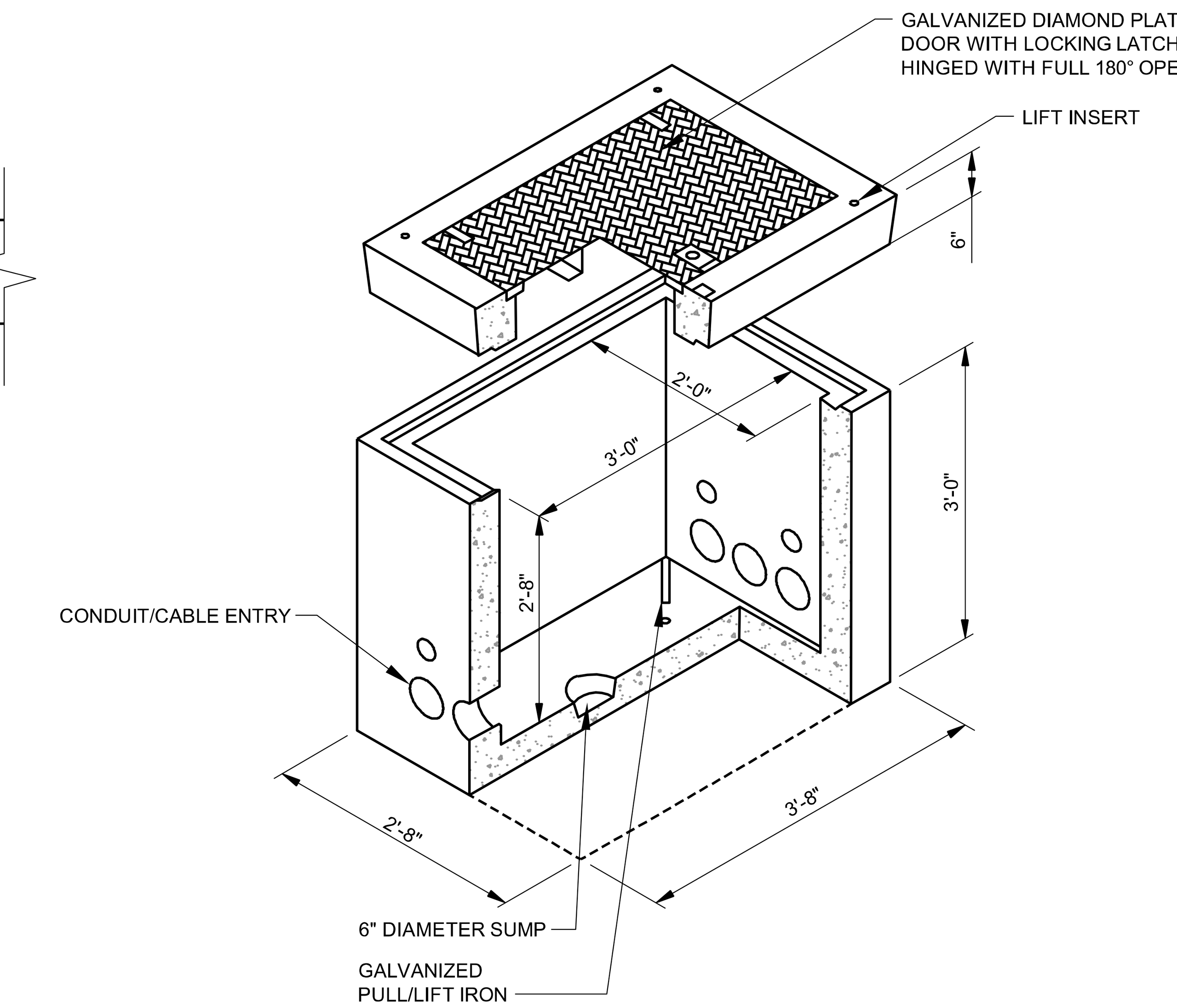
COMMUNICATIONS CONDUIT ROUTING TO RIVERSIDE

NO SCALE



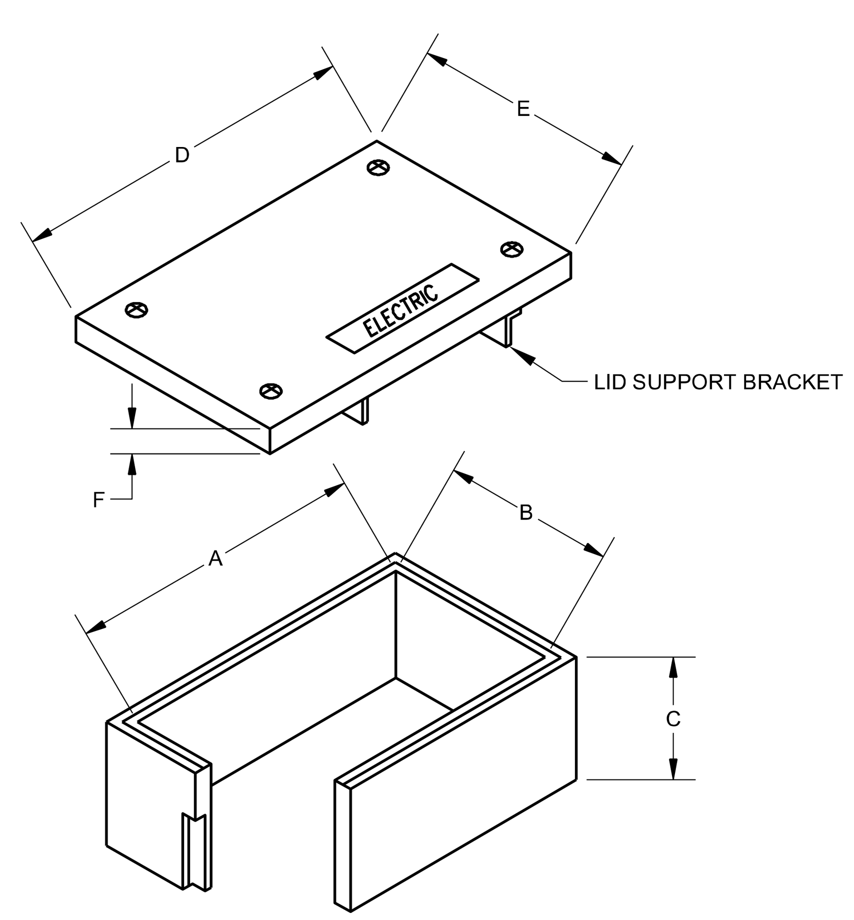
TYPICAL PLAN VIEW AT LIGHT POLES

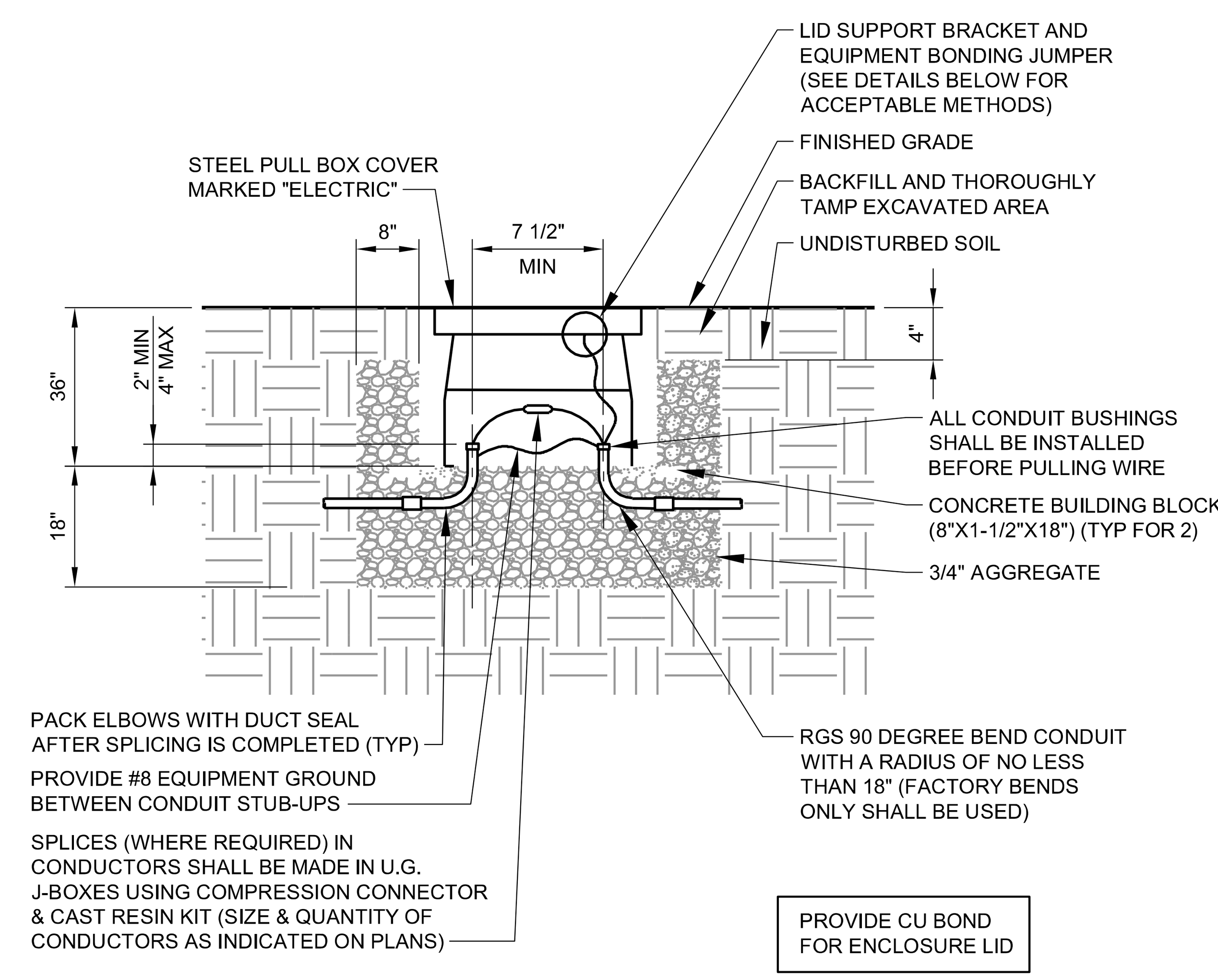
NO SCALE



UNDERGROUND COMMUNICATION CABLE VAULT DETAIL (RIVER SIDE)

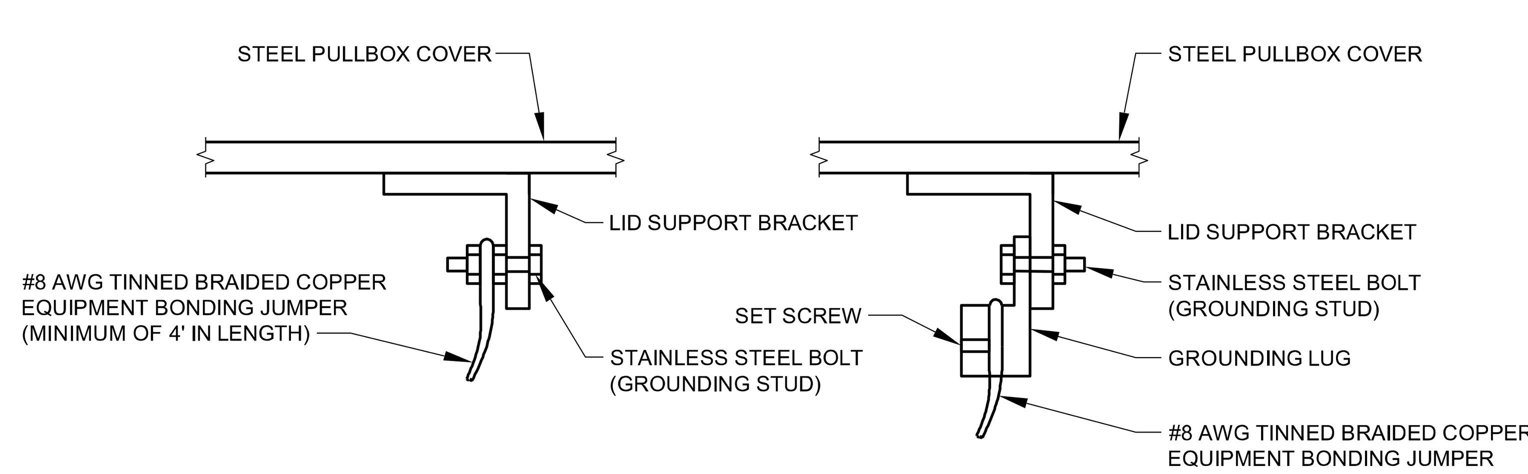
NO SCALE





NOTES:

1. INSTALL A 1/4"-20 NC X 3/4" STAINLESS STEEL GROUNDING STUD TO THE LID SUPPORT MEMBER(S) ON THE BOTTOM OF LID BY DRILLING A HOLE THROUGH THE "L", "C", OR "T"-SHAPED SUPPORT MEMBER. SECURE GROUNDING STUD AND BONDING JUMPER WITH TWO (2) STAINLESS STEEL NUTS AND FLAT WASHERS.
2. SECURE GROUNDING LUG TO THE LID SUPPORT MEMBERS TO THE BOTTOM OF LID BY DRILLING A HOLE THROUGH THE "L", "C", OR "T"-SHAPED SUPPORT MEMBER AND INSTALLING A 1/4"-20 NC X 3/4" STAINLESS STEEL GROUND STUD. INSERT BONDING JUMPER INTO GROUNDING LUG AND SECURE WITH SET SCREW.



TYPICAL HANDHOLE / PULL BOX DETAIL (COMM AND POWER, SECURE SIDE)

NO SCALE

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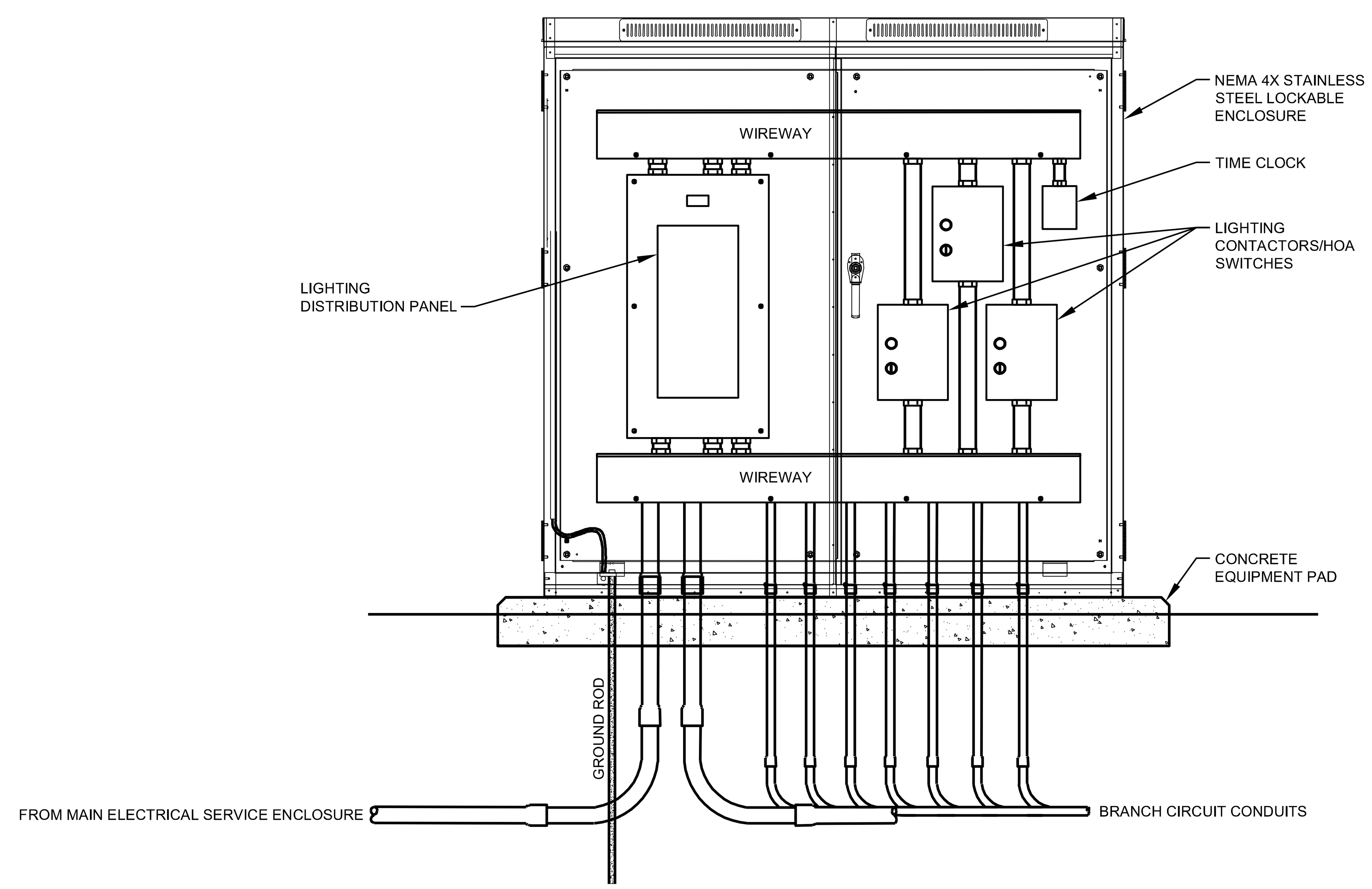
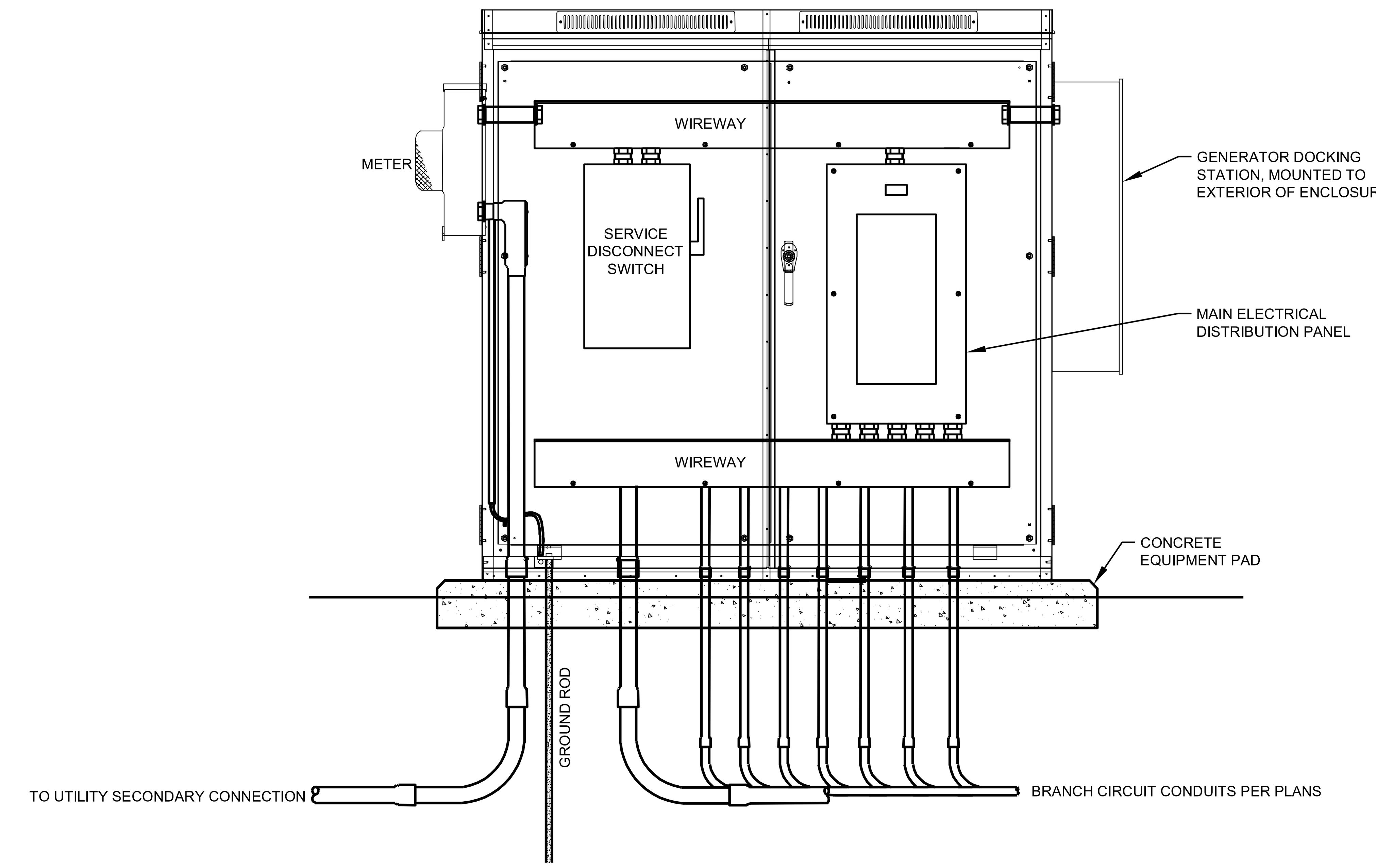
CONDUIT ROUTING DETAILS

SHEET ID
LAGRULLA
E-501



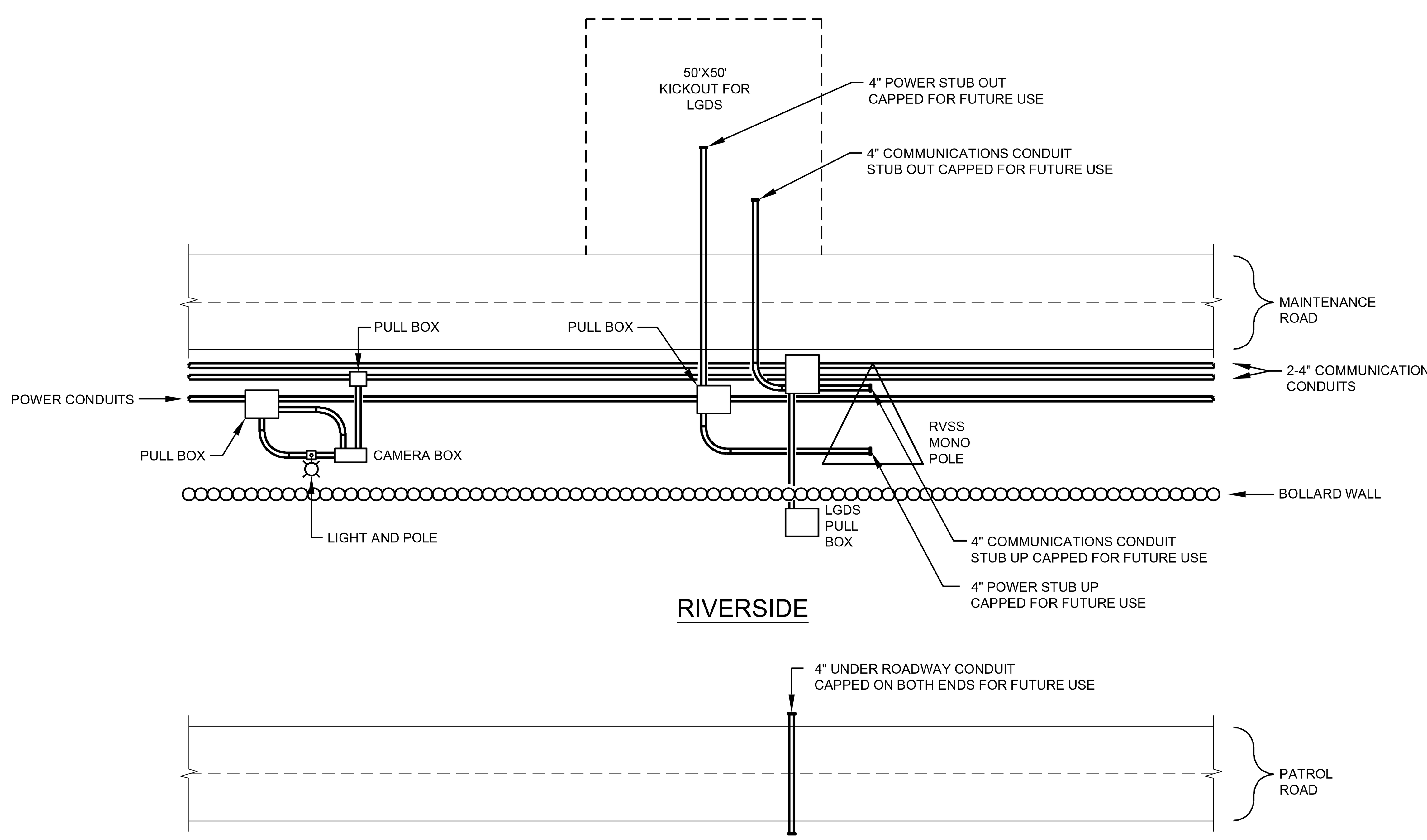
TYPICAL LIGHTING DISTRIBUTION ENCLOSURE

NOT TO SCALE



TYPICAL UTILITY CONNECTION POINT ELECTRICAL SERVICE ENCLOSURE

NOT TO SCALE



RVSS TOWER TYPICAL PLAN VIEW

NOT TO SCALE

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MARK | DESCRIPTION | DATE

ISSUED DATE:
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

DESIGNED BY: M.J. HILL
DRAWN BY: D.A. NELSON
CHECKED BY:
SUBMITTED BY:
SIZE: ANSI D

US ARMY CORPS OF ENGINEERS
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2000 FORD POINT ROAD
GALVESTON, TX 77553-1229

ETEGRA
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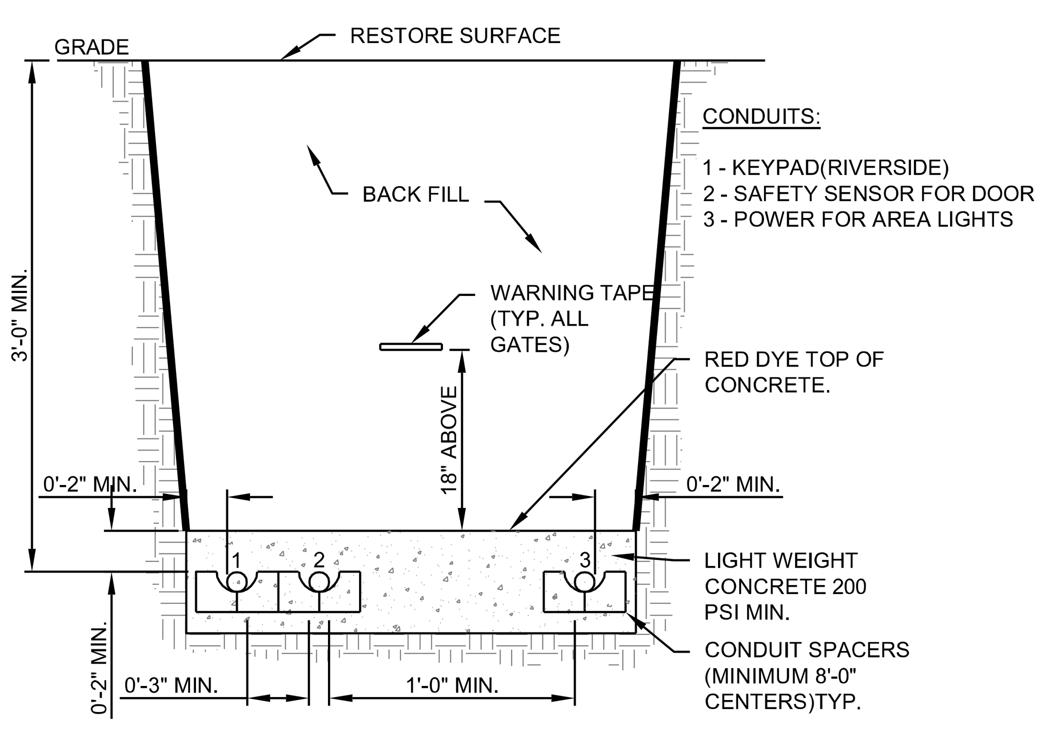
DALLAS, TX, 75252

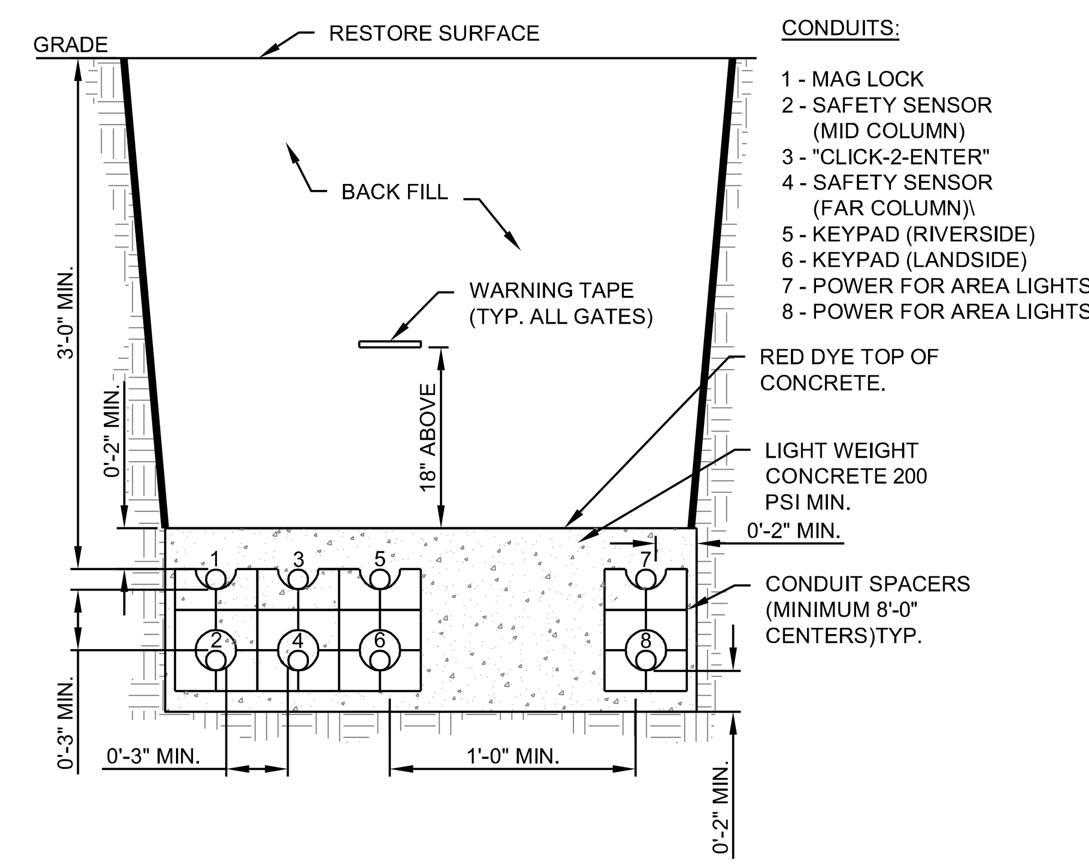
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE
RVSS TOWER YARD EQUIPMENT DETAILS

SHEET ID
LAGRULLA
E-502



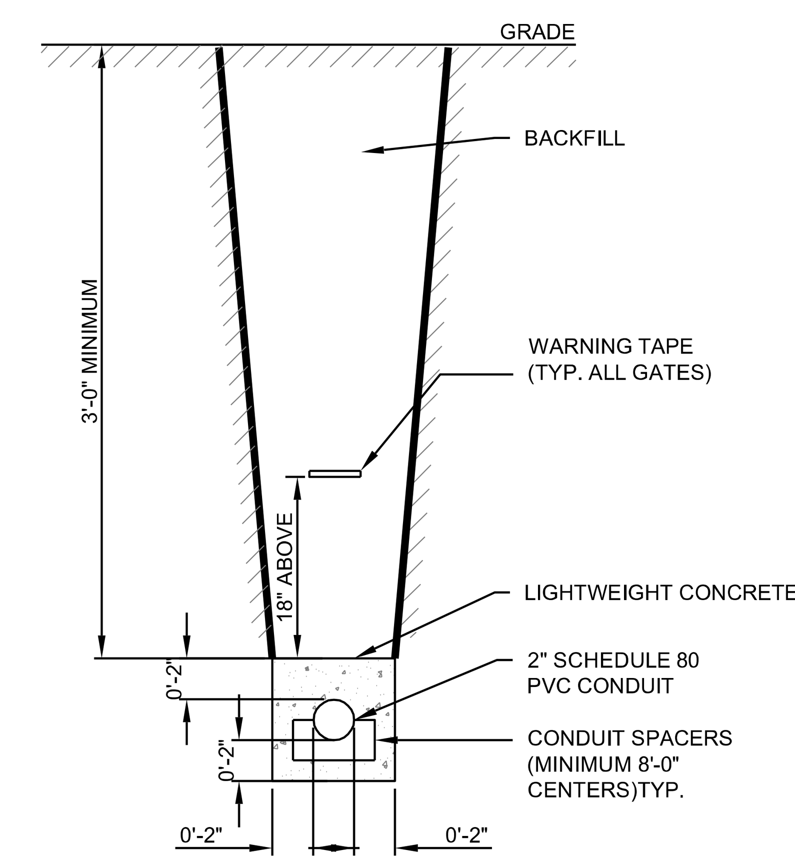
GATE POWER, SECURITY, AND CONTROLS DUCT BANK SECTION

NO SCALE



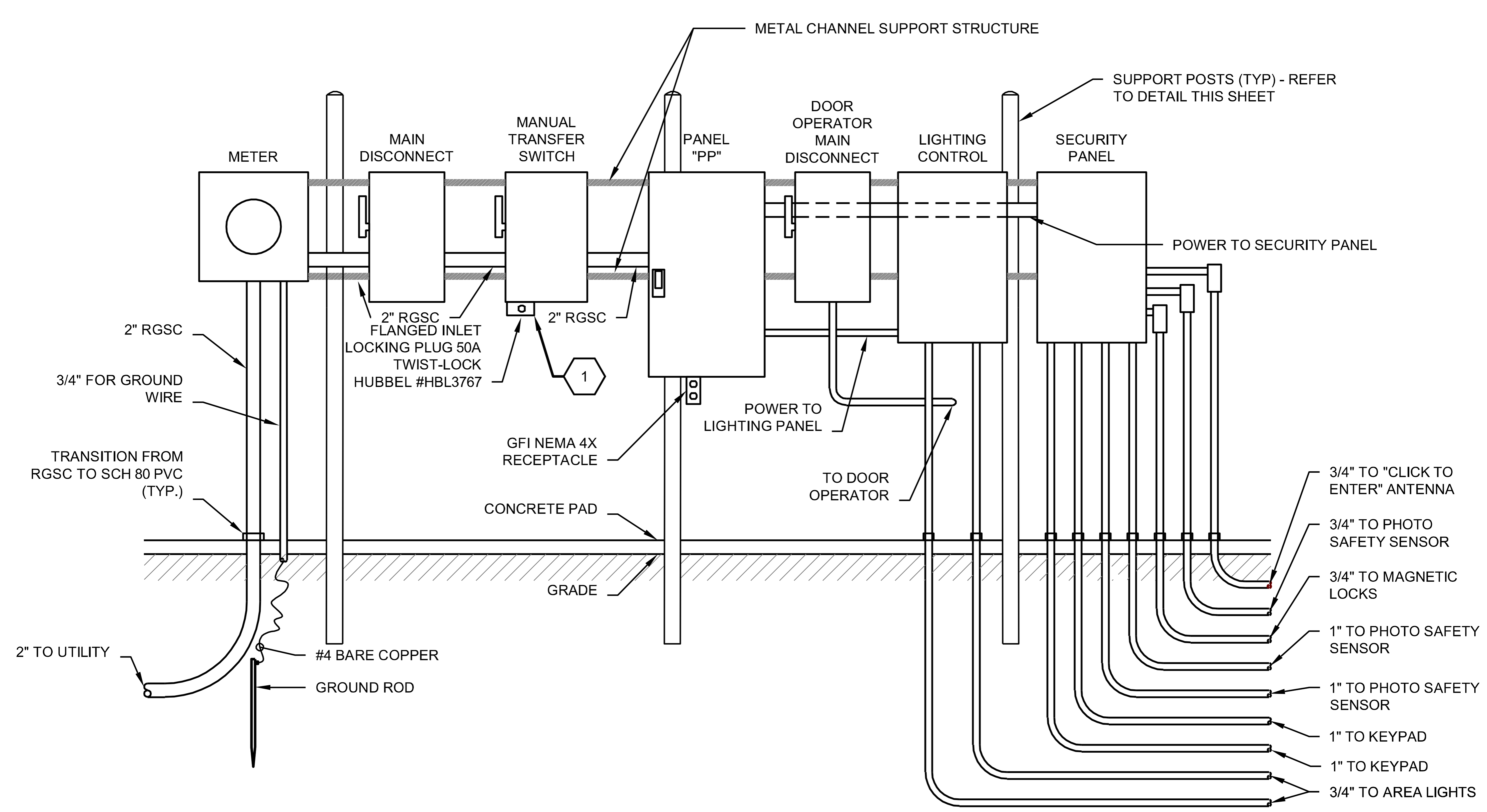
GATE POWER, SECURITY, AND CONTROLS DUCT BANK SECTION

NO SCALE



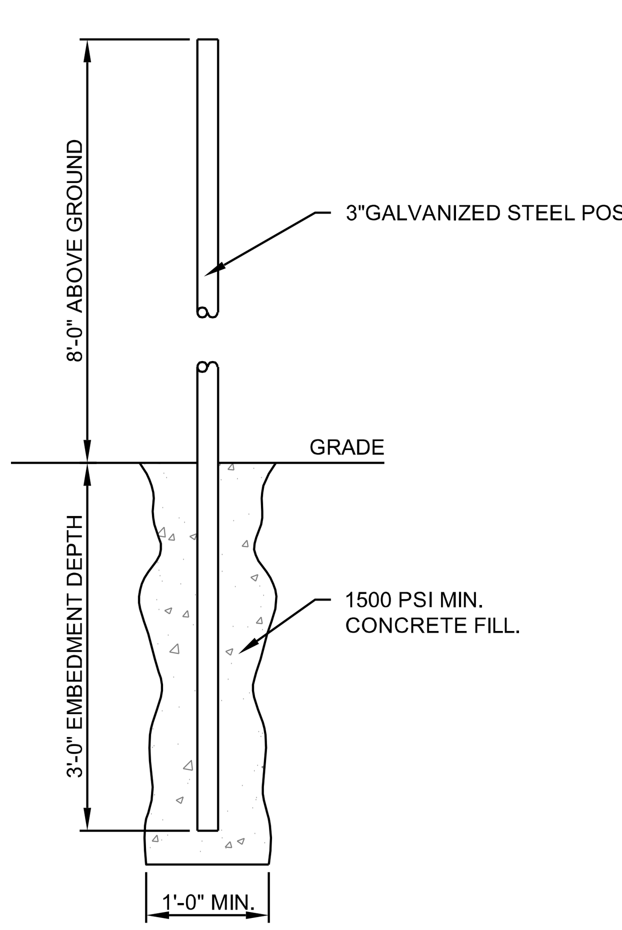
ELECTRICAL SERVICE DUCT BANK

NO SCALE



GATE POWER, SECURITY, AND CONTROLS PANEL ELEVATION DETAIL

NO SCALE



MOUNTING POLE DETAIL

NO SCALE

GENERAL NOTES

1. PROVIDE SUPPORT POSTS AND UNISTRUT MOUNTING RAILS AS REQUIRED. ALL STRUCTURE, CLAMPS AND ACCESSORIES SHALL BE CORROSION RESISTANT.
2. ALL BELOW GRADE CONDUIT SHALL BE SCHEDULE 80 PVC.
3. ALL ABOVE GRADE CONDUIT SHALL BE RIGID GALVANIZED STEEL CONDUIT.
4. ALL HARDWARE SHALL BE STAINLESS STEEL, WHERE POSSIBLE.
5. UNDERGROUND CONDUITS SHALL BE CONTINUOUSLY MARKED WITH FOIL-BACKED ELECTRICAL WARNING TAPE "CAUTION - ELECTRICAL LINE BURIED BELOW" WARNING TAPE SHALL BE INSERTED 18" ABOVE THE CENTER OF THE TOP OF THE CONDUITS.
6. WHERE ELECTRICAL EQUIPMENT IS EXPOSED TO THE ENVIRONMENT PROVIDE NEMA 4X ENCLOSURES. PROVIDE WEATHERPROOF ENCLOSURES FOR RECEPTACLES.

XX KEYED NOTES

1. THE FLANGED INLET LOCKING PLUG SHALL BE INSTALLED WITH A GASKET BETWEEN THE PLUG AND THE ENCLOSURE

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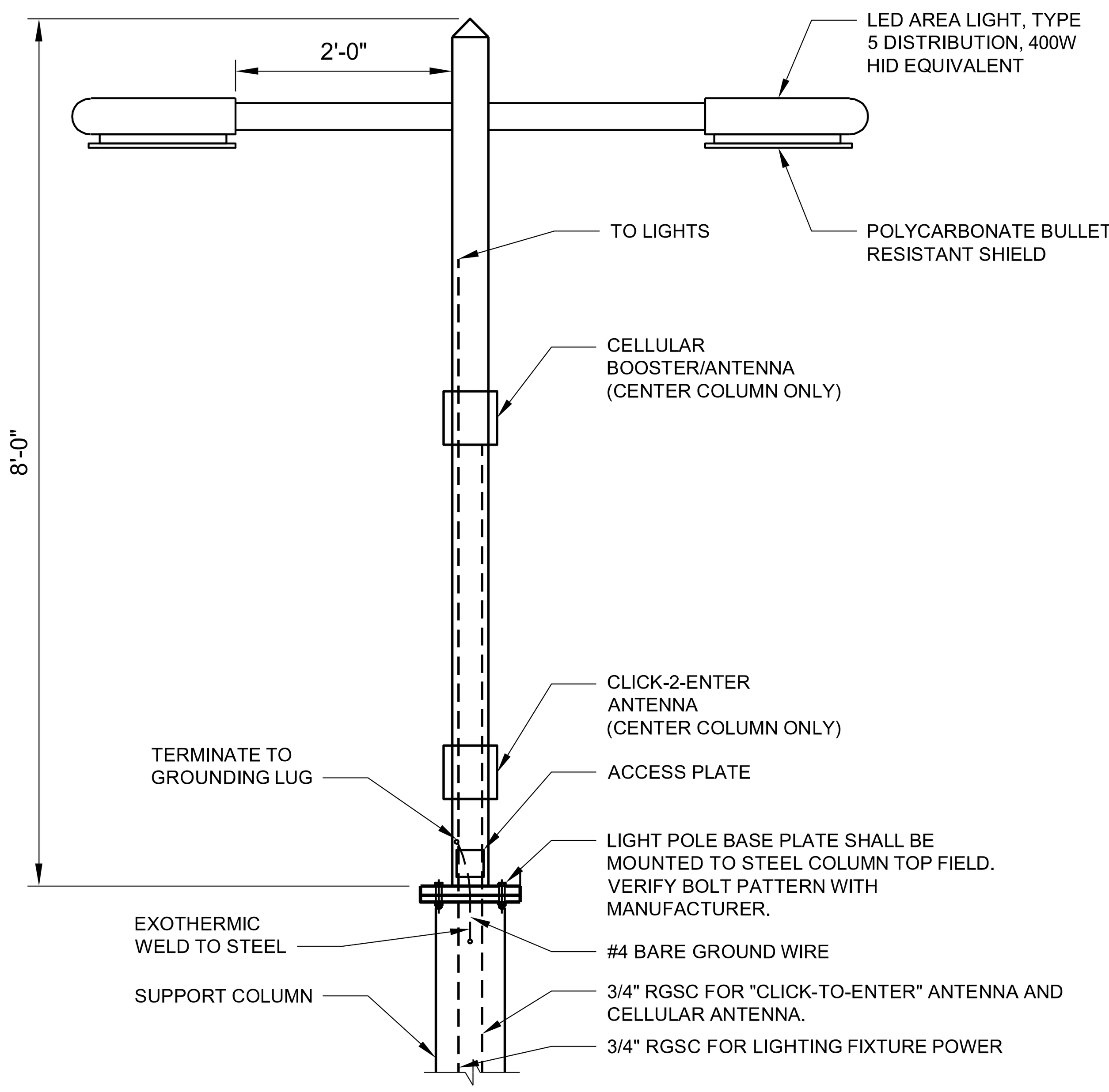
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE

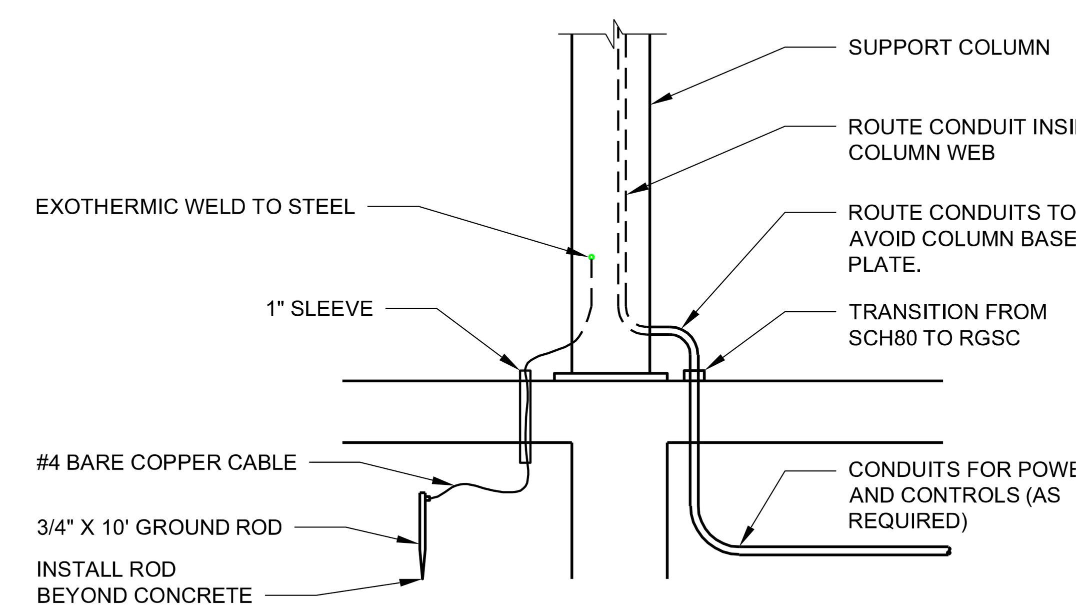
ELECTRICAL DETAILS - SHEET 1
50 FEET SINGLE LEAF AUTOMATED GATE

SHEET ID
LAGRULLA
E-503



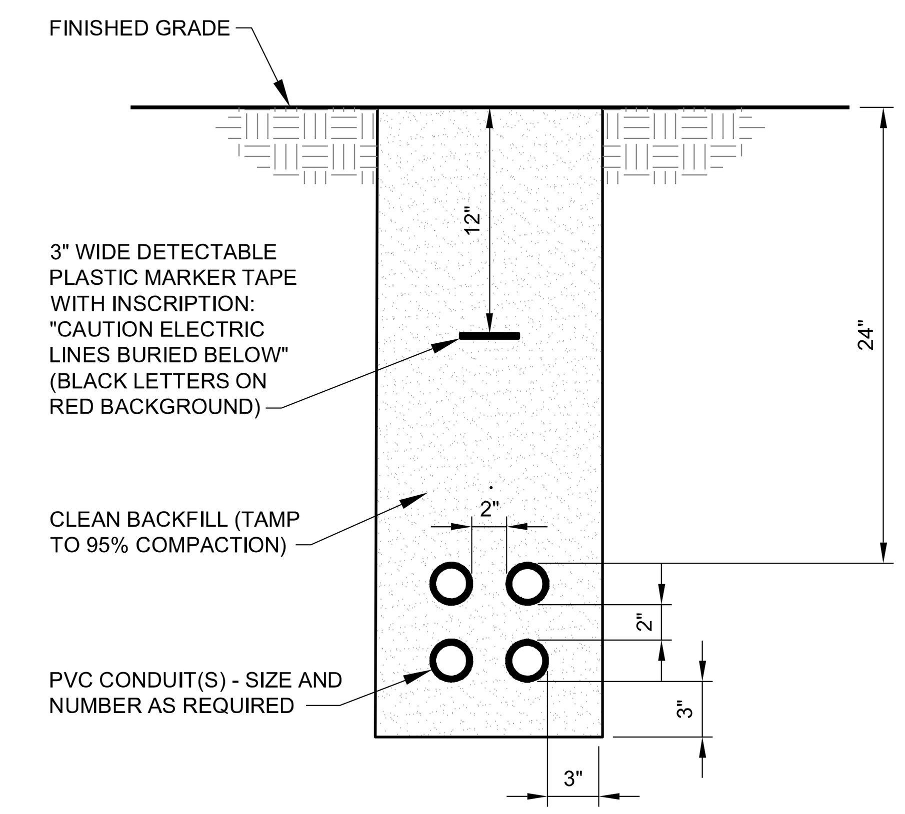
GATE LIGHT POLE DETAIL

NO SCALE



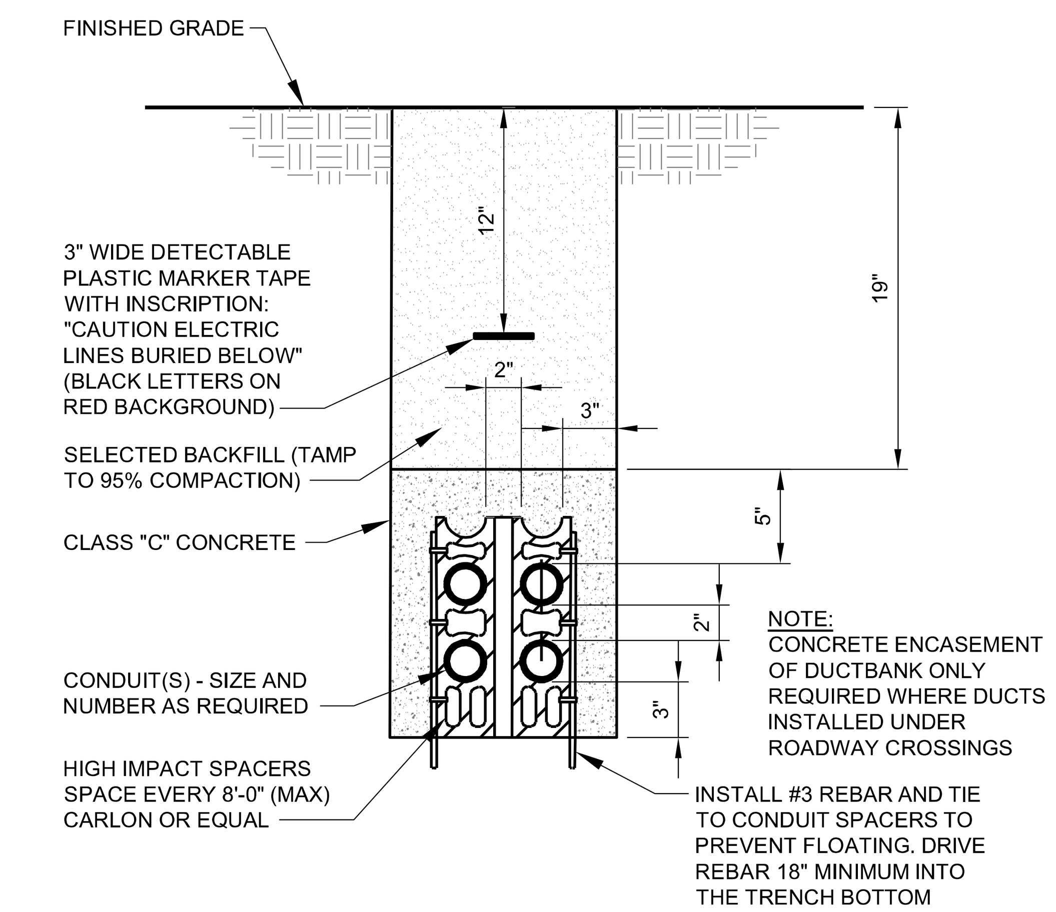
GATE POLE DETAIL AT COLUMN BASE

NO SCALE



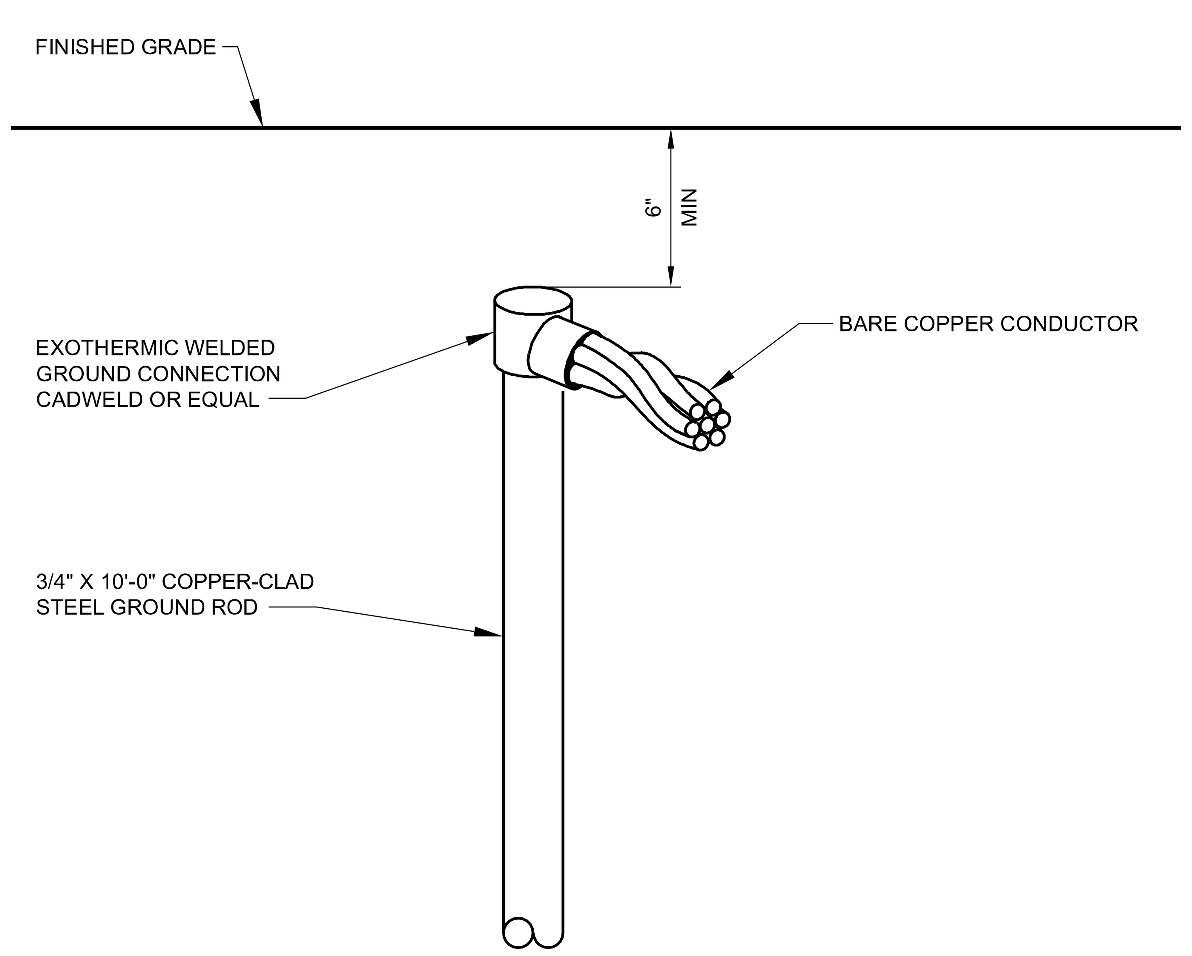
TYPICAL DIRECT BURIED DUCTBANK DETAIL

NO SCALE



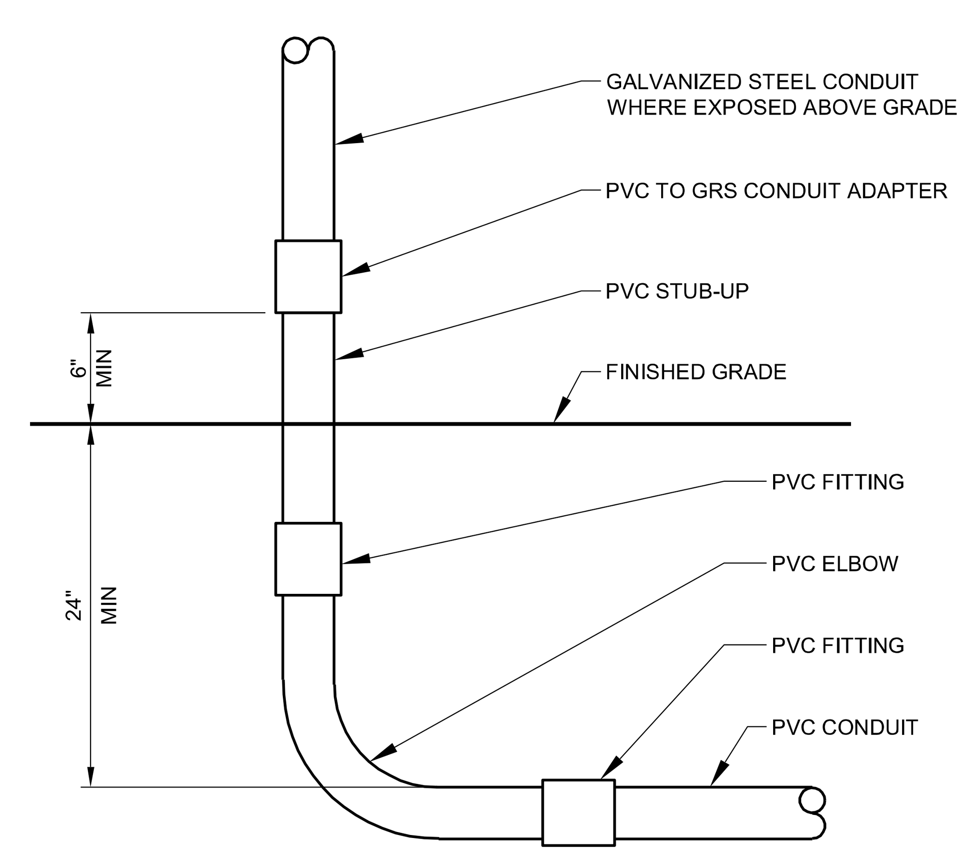
TYPICAL CONCRETE ENCASED DUCTBANK DETAIL

NO SCALE



TYPICAL GROUND ROD DETAIL

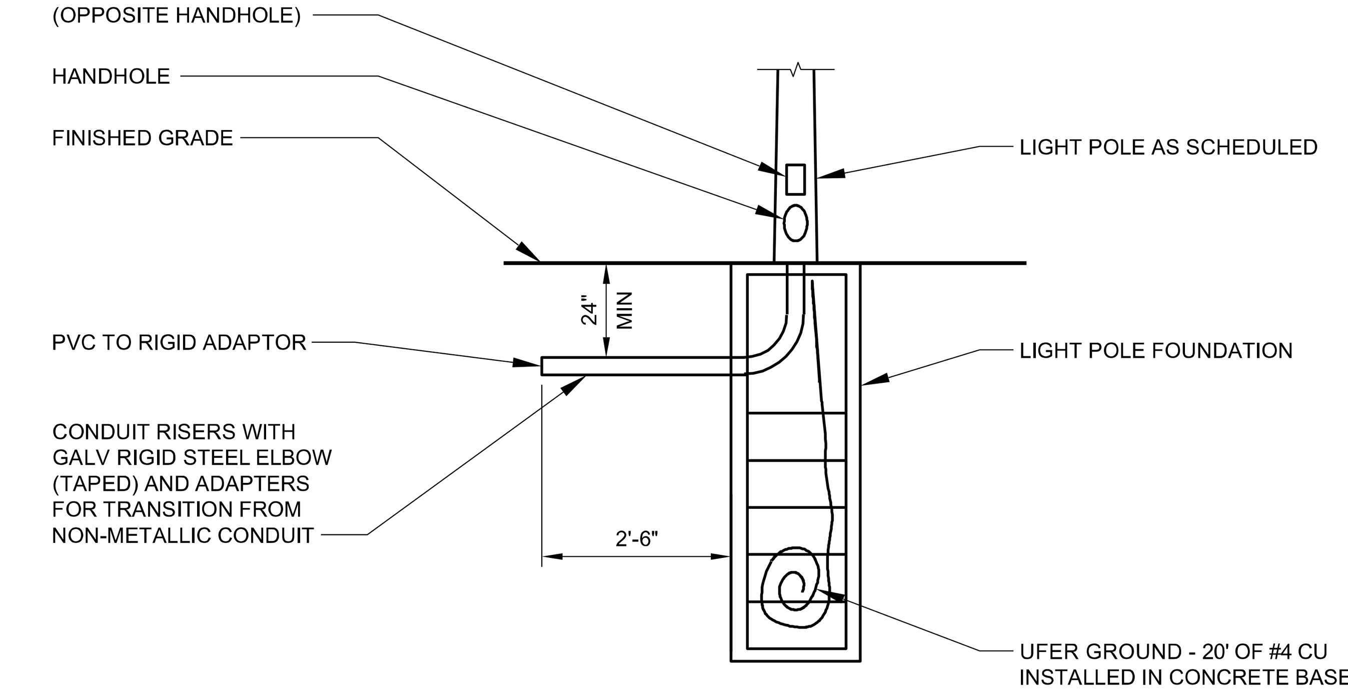
NO SCALE



NOTE:
WHERE CONDUITS ARE RUN IN SLAB, THE 24" DIMENSION DOES NOT APPLY.

TYPICAL CONDUIT STUB-UP DETAIL

NO SCALE



TYPICAL LIGHT POLE GROUNDING DETAIL

NO SCALE

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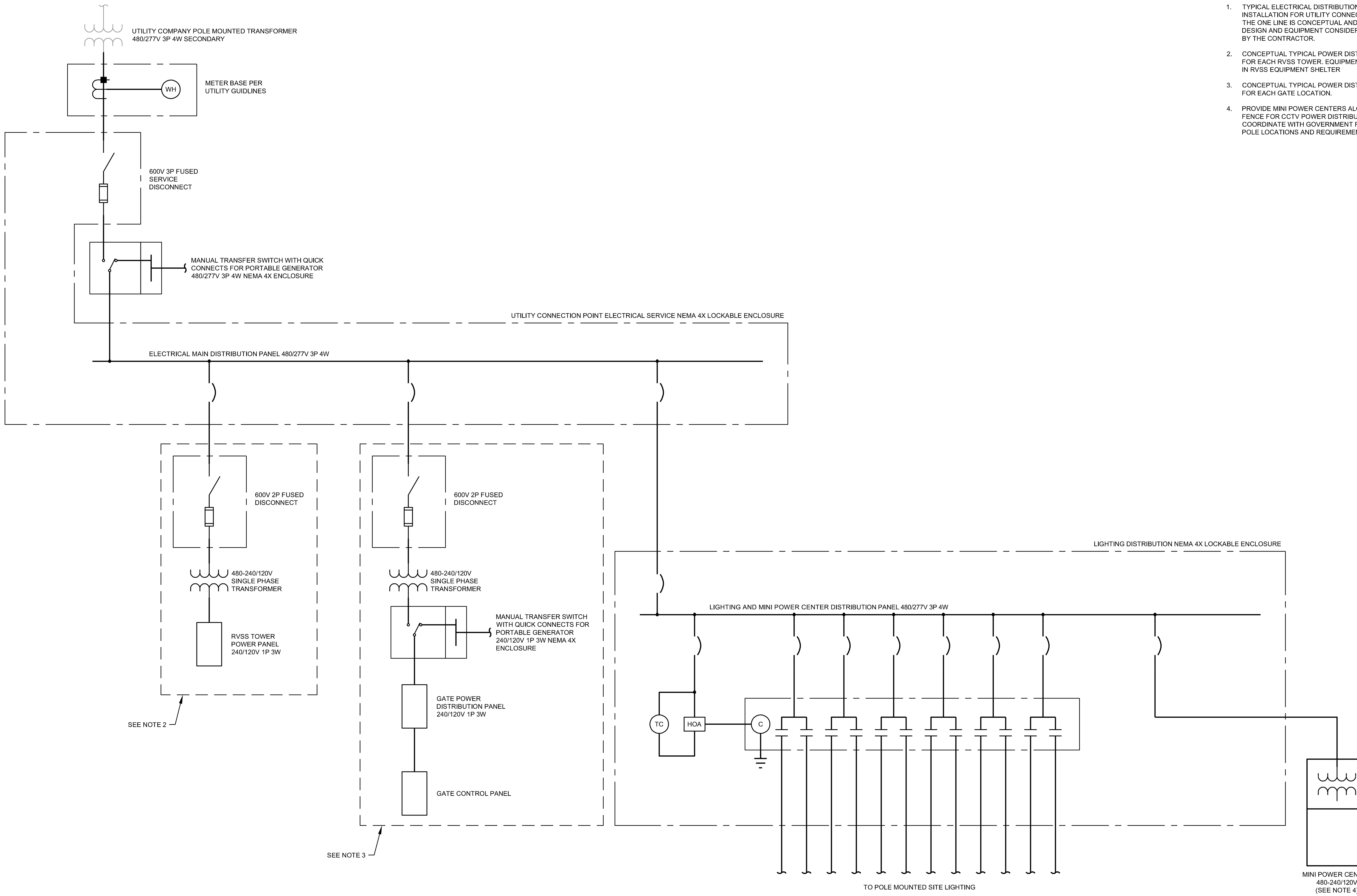
RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE

ELECTRICAL DETAILS - SHEET 2
50 FEET SINGLE LEAF AUTOMATED GATE

SHEET ID
LAGRULLA
E-504

NOTES:

1. TYPICAL ELECTRICAL DISTRIBUTION EQUIPMENT INSTALLATION FOR UTILITY CONNECTION POINT. THE ONE LINE IS CONCEPTUAL AND FINAL DESIGN AND EQUIPMENT CONSIDERATIONS ARE BY THE CONTRACTOR.
2. CONCEPTUAL TYPICAL POWER DISTRIBUTION FOR EACH RVSS TOWER. EQUIPMENT LOCATED IN RVSS EQUIPMENT SHELTER
3. CONCEPTUAL TYPICAL POWER DISTRIBUTION FOR EACH GATE LOCATION.
4. PROVIDE MINI POWER CENTERS ALONG THE FENCE FOR CCTV POWER DISTRIBUTION. COORDINATE WITH GOVERNMENT FOR LIGHT POLE LOCATIONS AND REQUIREMENTS.



CONCEPTUAL UTILITY SERVICE POINT ELECTRICAL ONE-LINE DIAGRAM

NO SCALE

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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE
CONCEPTUAL ONE-LINE DIAGRAM

SHEET ID
LAGRULLA
E-601

Panel: PP

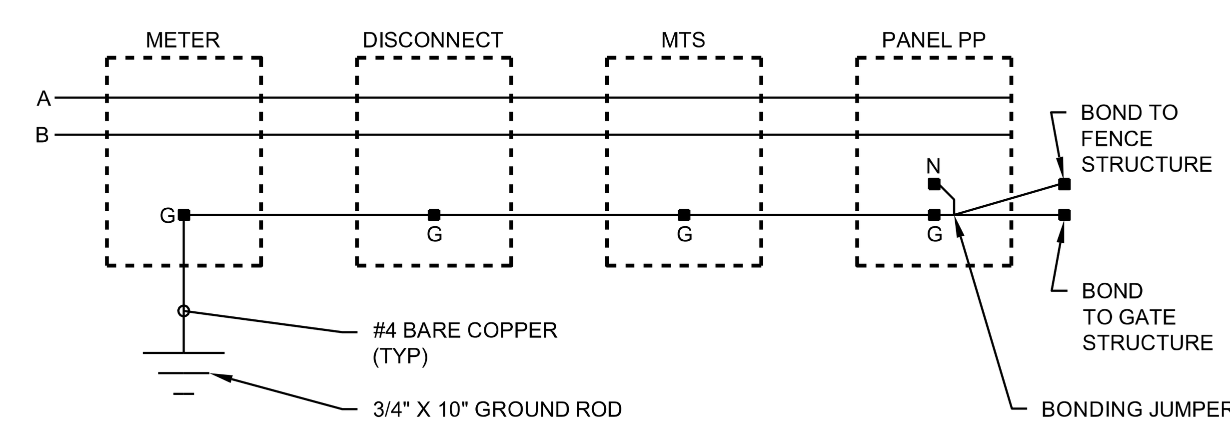
Location:		Volts: 240/120V	A.I.C Rating: 10,000
Supply From: MTS		Phases: 1 P	Mains Type: MCB
Mounting: Surface		Wires: 3 Wire	Mains Rating: 200A
Enclosure: NEMA 4X			MCB Rating: 200A

CKT	Circuit Description	Trip	Poles	A		B		Poles	Trip	Circuit Description	CKT
1	DOOR OPTR (7.5HP)	70A	2P	2460	0			2P	20A	SURGE SUPPRESSOR	2
3	-	-	-			2460	0	-	-	-	4
5	GFCI OUTLETS	20A	1P	180	400			1P	20A	SECURITY PANEL	6
7	LIGHTS	20A	1P			723	1000	1P	20A	SECURITY PANEL	8
9	LIGHTS	20A	1P	241	-			1P	20A	Spare	10
11	Spare	20A	1P			-	-	1P	20A	Spare	12
13	Spare	20A	1P	-	-			1P	20A	Spare	14
15	Spare	20A	1P			-	-	1P	20A	Spare	16
17	Spare	20A	1P					1P	20A	Spare	18
19	Spare	20A	1P			-	-	1P	20A	Spare	20
21	Spare	20A	1P	-	-			1P	20A	Spare	22
23	Spare	20A	1P			-	-	1P	20A	Spare	24
			Total Load:	3281	VA	4183	VA				
			Total Amps:	27.3	Amps	34.9	Amps				

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Power	1303	100%	1303	Total Conn. Load (VA):	7187
Lighting	964	125%	1205	Total Est. Demand (VA):	7428
Motor/HVAC	4920	100%	4920	Total Amps:	31.0

GATE ELECTRICAL PANEL SCHEDULE

NO SCALE



GATE GROUNDING DETAIL

NO SCALE

LUMINAIRE SCHEDULE										
TYPE	GENERAL DESCRIPTION	LIGHT SOURCE DATA				DRIVER/BALLAST		POWER DATA		NOTES
		LAMP TYPE	QTY x WATTS/LAMP	LAMP CODE/LED MODULE	LED DELIVERED LUMENS	CONTROL TYPE	DIMMING	SUPPLY VOLT	WATTS PER FIXT.	
	POLE MOUNTED LIGHT FIXTURE, 27FT POLE. REFERENCE SPECIFICATIONS FOR REQUIREMENTS FOR POLE, FIXTURE, AND ACCESSORIES	LED	BY CONTRACTOR	FURNISHED WITH FIXTURE	BY CONTRACTOR	NA	0-10V	480V	1200W MAX	

SITE LUMINAIRE SCHEDULE

NO SCALE

GENERAL NOTES

1. ALL ELECTRICAL EQUIPMENT SHALL BE RATED NEMA 4X
2. ALL ELECTRICAL EQUIPMENT SHALL BE RATED FOR 10KAIC MINIMUM.
3. ALL CONDUCTORS SHALL BE #12 AWG UNLESS NOTED OTHERWISE

CALCULATIONS

ASSUMPTIONS:

TRANSFORMER SIZE: 25kVA
IMPEDANCE: 1.58 Z (ESTIMATED)
UPSTREAM BUS CAPACITY: INFINATE
DISTANCE FROM TRANSFORMER: 50FT

SHORT CIRCUIT CURRENT:

IFL = (XFMR SIZE x 1000) / (VOLTAGE(LINE-LINE))

IFL = (25 x 1000) / (240) = 104.16A

IsC = IFL / %Z

IsC = (104.16A) / (.0158) = 6592 AMPS MAX

M = 1 / (1+F)

F = (2x(DISTANCE) x IsC) / ((CONSTANT) x (VOLTAGE))

F = (2 x 50FT x 6592A) / (13923 x 240) = 0.1972

M = 1 / (1 + 0.1972) = .8352

IsC(actual) = (6592 x 0.8352) = 5506A

PANEL BOARD MINIMUM
AIC = 10K AIC

ABBREVIATIONS

M = MULTIPLIER
F = FACTOR
IsC = SHORT CIRCUIT CURRENT

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DATE
DESCRIPTION
MARK

ISSUED DATE:
SOLICITATION NO:
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ETEGRA
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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY
(RGV)
CONSTRUCTION OF BARRIER FENCE

ELECTRICAL SCHEDULES & DIAGRAMS
50 FEET SINGLE LEAF AUTOMATED GATE

SHEET ID
LAGRULLA
E-602

SHEET NOTES

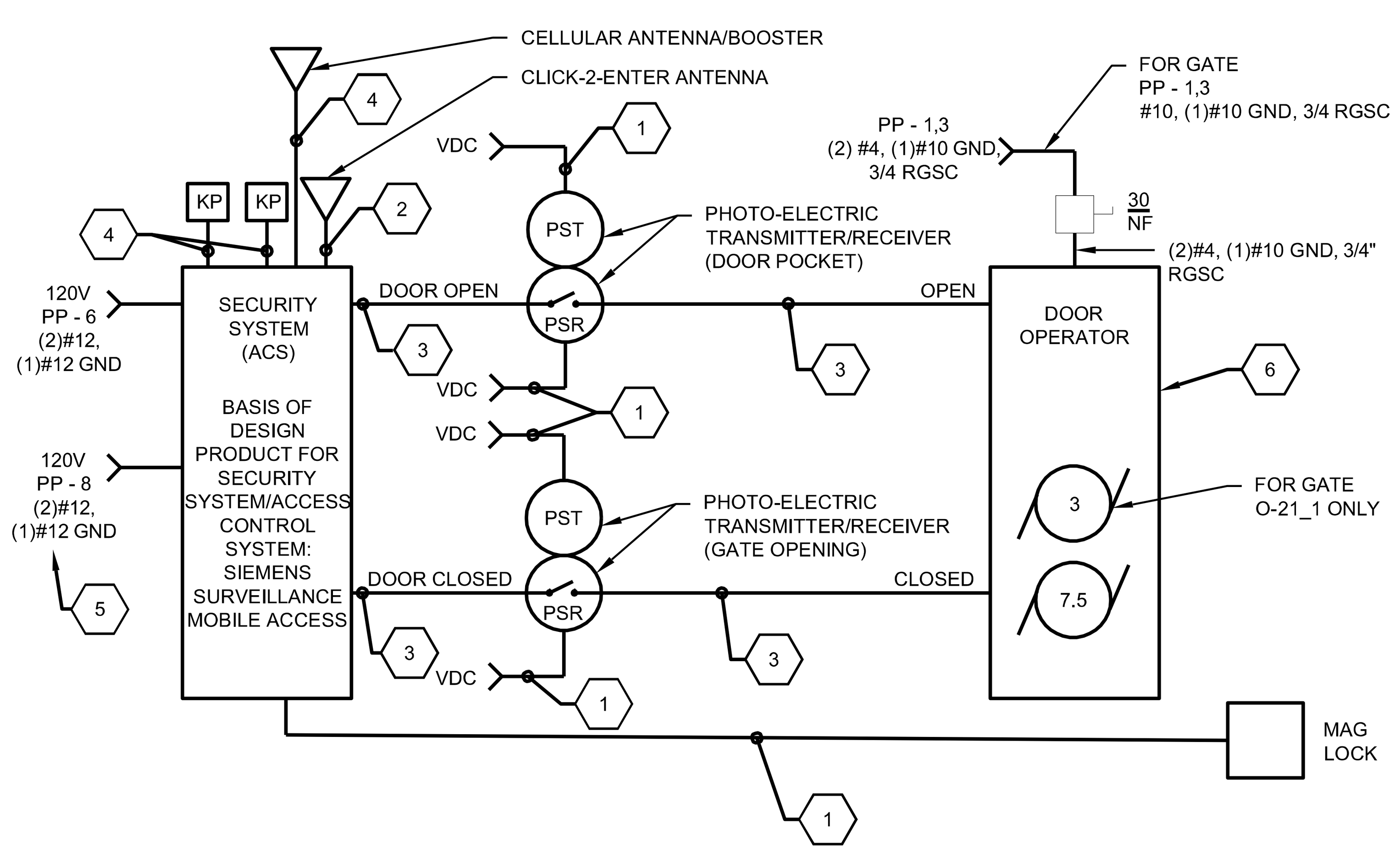
1. 2 #12 (POWER) FROM SECURITY PANEL
2. 2 #12 (POWER) + 2 #16 (DOOR OPEN SIGNAL)
3. 2 #16 (CONTROL)
4. SPECIALITY CABLE PER MANUFACTURER
5. POWER FOR CELLULAR ANTENNA BOOSTER. EXTEND CONDUCTORS/CONDUIT TO DEVICE LOCATION.
6. BASIS OF DESIGN PRODUCT FOR DOOR OPERATOR IS: DOOR KING 9575 W/ HEAVY DUTY HOUSING OPTION.
7. CONNECT TO ONE FIXTURE NEAREST TO PANELS (LANDSIDE)

LUMINAIRE SCHEDULE

TYPE	GENERAL DESCRIPTION	LIGHT SOURCE DATA				DRIVER/BALLAST		POWER DATA		MANUFACTURER AND CATALOG NUMBER SERIES	NOTES
		LAMP TYPE	QTY x WATTS/LAMP	LAMP CODE/LED MODULE	LED DELIVERED LUMENS	CONTROL TYPE	DIMMING	SUPPLY VOLT	WATTS PER FIXT.		
A	DSX1 LED P9 50K T5W MVOLT (LITHONIA LIGHTING)	LED	NA	FURNISHED WITH FIXTURE	28805	NA	0-10V	120V	241	DSX1 LED P9 50K T5W MVOLT (LITHONIA LIGHTING)	

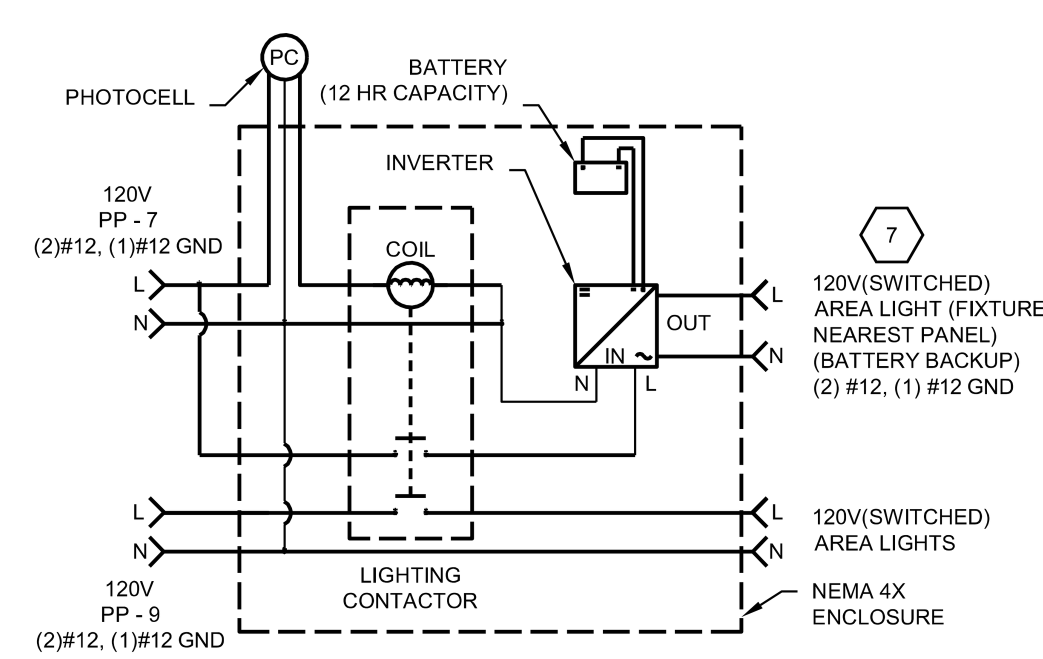
GATE LUMINAIRE SCHEDULE

NO SCALE



GATE CONTROL DIAGRAM

NO SCALE



GATE LIGHTING CONTACTOR DIAGRAM

NO SCALE

US Army Corps of Engineers ®

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RGV 06 - BORDER INFRASTRUCTURE
CONSTRUCTION PROJECT RIO GRANDE VALLEY (RGV)
CONSTRUCTION OF BARRIER FENCE

ELECTRICAL CONTROL SCHEMATIC
50 FT. SINGLE LEAF AUTOMATED GATE

SHEET ID
LAGRULLA
E-603

APPENDIX B – NOT USED

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APPENDIX C- TECHNICAL SPECIFICATIONS

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PROJECT TABLE OF CONTENTS

-- End of Project Table of Contents --

SECTION 02 41 00

DEMOLITION
05/10

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 145	(1991; R 2012) Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
AASHTO T 180	(2017) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.6	(2006) Safety Requirements for Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61	National Emission Standards for Hazardous Air Pollutants

1.2 PROJECT DESCRIPTION

1.2.1 Demolition/Deconstruction Plan

Prepare a Demolition Plan and submit proposed salvage, demolition, deconstruction, and removal procedures for approval before work is started. Include in the plan procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Coordinate with Waste Management Plan. Provide procedures for safe conduct of the work in accordance with EM 385-1-1. Plan shall be approved by Contracting Officer prior to work beginning.

1.2.2 General Requirements

Do not begin demolition or deconstruction until authorization is received from the Contracting Officer. Remove rubbish and debris from the project site. The work includes demolition and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

1.3 ITEMS TO REMAIN IN PLACE

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract. Do not overload structural elements or pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition, deconstruction, or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

1.3.1 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove dust, dirt, and debris from work areas daily.

1.3.2 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations.

1.3.3 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, must remain standing without additional bracing, shoring, or lateral support until demolished or deconstructed, unless directed otherwise by the Contracting Officer. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract.

1.4 BURNING

The use of burning at the project site for the disposal of refuse and

debris will not be permitted.

1.5 AVAILABILITY OF WORK AREAS

Areas in which the work is to be accomplished will be available in accordance with the following schedule:

Schedule	
Area	Date
~~[______]~~Roma	~~[~~_____~~]~~April 2019
Rio Grande City	April 2019
La Grulla	April 2019

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Demolition Plan
Existing Conditions

SD-07 Certificates

Notification
Notification of Demolition and Renovation Form

SD-11 Closeout Submittals

Receipts

1.7 QUALITY ASSURANCE

Submit timely notification of demolition projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61, Subpart M. Notify the local air pollution control district/agency and the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61, Subpart M. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ASSE/SAFE A10.6. Comply with the Environmental Protection Agency requirements specified. Use of explosives [will] [will not] be permitted.

1.7.1 Dust and Debris Control

Prevent the spread of dust and debris and avoid the creation of a nuisance or hazardin the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.

1.8 PROTECTION

1.8.1 Traffic Control Signs

Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Anchor barricades in a manner to prevent displacement by wind.Notify the Contracting Officer prior to beginning such work.

1.8.2 Protection of Personnel

Before, during and after the demolition work continuously evaluate the condition of the work being demolished and take immediate action to protect all personnel working in and around the project site. No area or structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.9 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair or replace items to be relocated which are damaged by the Contractor with new undamaged items as approved by the Contracting Officer.

1.10 EXISTING CONDITIONS

Before beginning any demolition or deconstruction work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized 4 inch will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, finish floor elevations, possible conflicting electrical conduits, plumbing lines, alarms systems, the location and extent of existing cracks and other damage and description of surface conditions that exist prior to before starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document. Submit survey results.

PART 2 PRODUCTS

2.1 FILL MATERIAL

a. Comply with excavating, backfilling, and compacting procedures for soils used as backfill material to fill voids, depressions or excavations resulting from demolition or deconstruction of structures. Fill material shall be waste products from demolition or deconstruction until all waste appropriate for this purpose is consumed.

b. Fill material shall conform to the definition of satisfactory soil material as defined in AASHTO M 145, Soil Classification Groups A-1, A-2-4, A-2-5 and A-3. In addition, fill material shall be free from roots and other organic matter, trash, debris, frozen materials, and stones larger than 2 inches in any dimension.

c. Proposed fill material must be sampled and tested by an approved soil testing laboratory, as follows:

Soil classification	AASHTO M 145
Moisture-density relations	AASHTO T 180, Method B or D

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

Inspect and evaluate existing structures onsite for reuse. Existing construction scheduled to be removed for reuse shall be disassembled. Dismantled and removed materials are to be separated, set aside, and prepared as specified, and stored or delivered to a collection point for reuse, remanufacture, recycling, or other disposal, as specified. Materials shall be designated for reuse onsite whenever possible. Contractor shall notify the COR upon discovery of existing structures to be removed.

3.1.1 Structures

a. Remove all existing structures within the work areas to 2 feet below grade. Remove sidewalks, curbs, gutters and street light bases as indicated.

b. Demolish all structures in a systematic manner from the top of the structure to the ground. Remove structural members and lower to ground by means of derricks, platforms hoists, or other suitable methods as approved by the Contracting Officer.

c. Locate demolition and deconstruction equipment throughout the structure and remove materials so as to not impose excessive loads to existing roadways.

3.1.2 Utilities and Related Equipment

3.1.2.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition or deconstruction work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

3.1.2.2 Disconnecting Existing Utilities

Remove existing utilities, as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered but are not indicated on the drawings, notify the Contracting Officer prior to further work in that area. Remove meters and related equipment and deliver to a location in accordance with instructions of the Contracting Officer.

3.1.3 Paving and Slabs

Remove sawcut concrete and asphaltic concrete paving and slabs to a depth of 6 inches below new finish grade. Provide neat sawcuts at limits of

pavement removal as indicated. Pavement and slabs designated to be recycled and utilized in this project shall be moved, ground and stored as directed by the Contracting Officer. Pavement and slabs not to be used in this project shall be removed from the Installation at Contractor's expense.

3.1.4 Concrete

Saw concrete along straight lines to a depth of a minimum 2 inch. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete.

3.1.5 Structural Steel

Dismantle structural steel at field connections and in a manner that will prevent bending or damage. Flame-cutting torches are permitted when other methods of dismantling are not practical.

3.1.6 Electrical Equipment and Fixtures

3.1.6.1 Electrical Devices

Remove and salvage switches, switchgear, transformers, conductors including wire and nonmetallic sheathed and flexible armored cable, regulators, meters, instruments, plates, circuit breakers, panelboards, outlet boxes, and similar items. Box and tag these items for identification according to type and size.

3.1.6.2 Wiring Ducts or Troughs

Remove and salvage wiring ducts or troughs. Dismantle plug-in ducts and wiring troughs into unit lengths. Remove plug-in or disconnecting devices from the busway and store separately.

3.1.6.3 Conduit and Miscellaneous Items

Salvage conduit except where embedded in concrete or masonry. Consider corroded, bent, or damaged conduit as scrap metal. Sort straight and undamaged lengths of conduit according to size and type. Classify supports, knobs, tubes, cleats, and straps as debris to be removed and disposed.

3.2 CONCURRENT EARTH-MOVING OPERATIONS

Do not begin excavation, filling, and other earth-moving operations that are sequential to demolition or deconstruction work in areas occupied by structures to be demolished or deconstructed until all demolition and deconstruction in the area has been completed and debris removed.

3.3 DISPOSITION OF MATERIAL

3.3.1 Title to Materials

Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition and deconstruction, and materials and equipment to be

removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition, deconstruction, and removal procedures, and authorization by the Contracting Officer to begin demolition and deconstruction. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

3.4 DISPOSAL OF REMOVED MATERIALS

3.4.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations as contractually specified in the Waste Management Plan. Storage of removed materials on the project site is prohibited.

3.4.2 Burning on Government Property

Burning of materials removed from demolished and deconstructed structures will not be permitted on Government property.

3.4.3 Removal to Spoil Areas on Government Property

Transport noncombustible materials removed from demolition and deconstruction structures to designated spoil areas on Government property.

3.4.4 Removal from Government Property

Transport waste materials removed from demolished and deconstructed structures, except waste soil, from Government property for legal disposal. Dispose of waste soil as directed.

3.5 REUSE OF SALVAGED ITEMS

Recondition salvaged materials and equipment designated for reuse before installation. Replace items damaged during removal and salvage operations or restore them as necessary to usable condition.

-- End of Section --

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SECTION 03 20 00.00 10

CONCRETE REINFORCING
05/14

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 318	(2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)
ACI SP-66	(2004) ACI Detailing Manual

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4/D1.4M	(2011) Structural Welding Code - Reinforcing Steel

ASTM INTERNATIONAL (ASTM)

ASTM A1035/A1035M	(2016a) Standard Specification for Deformed and Plain, Low-carbon, Chromium, Steel Bars for Concrete Reinforcement
ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM A184/A184M	(2017) Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A370	(2017a) Standard Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A615/A615M	(2016) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

ASTM A675/A675M	(2014) Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
ASTM A884/A884M	(2014) Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
ASTM A934/A934M	(2016) Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 10MSP	(2009; 28th Ed; Errata) Manual of Standard Practice

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Butt-Splices

SD-02 Shop Drawings

Reinforcement

SD-03 Product Data

Mechanical Butt-Splices

Reinforcing Steel

SD-04 Samples

Epoxy-Coated Bars

SD-06 Test Reports

Tests, Inspections, and Verifications

SD-07 Certificates

Reinforcing Steel
Qualified Welders
Qualification of Steel Bar Butt-Splicers

1.3 QUALITY ASSURANCE

1.3.1 Welding Qualifications

Welders are required to be qualified in accordance with AWS D1.4/D1.4M.

Perform qualification test at the worksite and notify the Contracting Officer 24 hours prior to conducting tests. Special welding procedures and welders qualified by others may be accepted as permitted by AWS D1.4/D1.4M. Submit a list of qualified welders names.

1.3.2 Qualification of Steel Bar Butt-Splicers

Qualification of steel bar butt-splicers are required to be certified to have satisfactorily completed a course of instruction in the proposed method of butt-splicing or have satisfactorily performed such work within the preceding year. Submit certificates on the Qualifications of Steel Bar Butt-Splicers prior to commencing butt-splicing.

1.3.3 Qualification of Butt-Splicing Procedure

As a condition of approval of the butt-splicing procedure, make three test butt-splices of steel bars of each size to be spliced using the proposed butt-splicing method, in the presence of the Contracting Officer. Tension tested to destruction these test butt-splices and unspliced bars of the same size, with stress-strain curves plotted for each test. Test results must show that the butt-splices meet the specified strength and deformation requirements in order for the splicing procedure to be approved.

1.4 DELIVERY, STORAGE, AND HANDLING

Store reinforcement and accessories off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.1 DOWELS

Provide dowels conforming to ASTM A675/A675M, Grade 80 or ASTM A1035/A1035M. Steel pipe conforming to ASTM A53/A53M, Schedule 80, may be used as dowels provided the ends are closed with metal or plastic inserts or with mortar.

2.2 FABRICATED BAR MATS

Fabricated bar mats conforming to ASTM A184/A184M.

2.3 REINFORCING STEEL

Reinforcing steel of deformed bars conforming to ASTM A615/A615M, , or grades and sizes as indicated. Cold drawn wire used for spiral reinforcement must conform to ASTM A1064/A1064M.

Submit certified copies of mill reports attesting that the reinforcing steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified herein, prior to the installation of reinforcing steel.

Submit tests, inspections, and verifications of certified test reports for reinforcement steel showing that the steel complies with the applicable specifications. Test reports shall be furnished for each steel shipment and identified with specific lots prior to placement. Three copies of the heat analyses shall be provided for each lot of steel furnished and the Contractor shall certify that the steel conforms to the heat analyses.

2.3.1 Epoxy-Coated Bars

Epoxy-coated steel bars complying with the requirements of ASTM A934/A934M, including written certifications for coating material and coated bars, sample of coating material, and 1.5 pounds of patching material.

2.3.2 Mechanical Butt-Splices

Mechanical butt splices must be an approved exothermic, threaded coupling, swaged sleeve or other positive connecting type, and develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. In addition to this strength requirement, the additional deformation of number 14 and smaller bars due to slippage or other movement within the splice sleeve cannot exceed (unit strain)(0.015 inches unit strain 0.0015 inches/inch) beyond the elongation of an unspliced bar based upon a 10 inch gage length spanning the extremities of the sleeve at a stress of 30,000 psi. The additional deformation of number 18 bars must not exceed(unit strain) 0.03 inches (unit strain 0.003 inches/inch) beyond the elongation of an unspliced bar based upon a 10 inch gage length spanning the extremities of the sleeve at a stress of 30,000 psi. Determine the amount of the additional deformation from the stress-strain curves of the unspliced and spliced bars tested as required in paragraph QUALIFICATION OF BUTT-SPLICING PROCEDURE for qualification of the butt-splicing procedure.

2.4 WELDED WIRE REINFORCING

Welded wire reinforcing conforming to ASTM A1064/A1064M. When directed by the Contracting Officer for special applications, use welded wire reinforcing conforming to ASTM A884/A884M. For wire with a specified yield strength (fy) exceeding 60,000 psi, fy must be the stress corresponding to a strain of 0.35 percent.

2.5 WIRE TIES

Use wire ties that are 16 gauge or heavier black annealed steel wire.

2.6 SUPPORTS

Design bar supports for formed surfaces in accordance with CRSI 10MSP and fabricate of steel or precast concrete blocks. Provide precast concrete blocks with wire ties and not less than 4 inches square when supporting reinforcement on ground. Precast concrete block must have compressive strength equal to that of the surrounding concrete. Coat steel supports for coated or galvanized bars with electrically compatible material for a distance of at least 2 inches beyond the point of contact with the bar. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, use galvanized, plastic protected or stainless steel supports within 1/2 inch of concrete surface. Concrete supports used in concrete exposed to view must have the same color and texture as the finish surface. For slabs on grade and topping slabs on steel deck, supports use precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

Provide bar supports complying with the requirements of ACI SP-66. Provide plastic-coated wire, stainless steel or precast concrete supports for bars in concrete with formed surfaces exposed to view or to be painted. Use wedge-shaped precast concrete supports, not larger than 3-1/2 by 3-1/2 inches, of thickness equal to that indicated for concrete cover and with an

embedded hooked tie-wire for anchorage. Bar supports used in precast concrete with formed surfaces exposed to view must be the same quality, texture and color as the finish surfaces.

2.7 TESTS, INSPECTIONS, AND VERIFICATIONS

Perform material tests, specified and required by applicable standards, by an approved laboratory and certified to demonstrate that the materials are in conformance with the specifications. Perform and certify tests, inspections, and verifications and certify. Submit certified tests reports of reinforcement steel showing that the steel complies with the applicable specifications for each steel shipment and identified with specific lots prior to placement. Submit three copies of the heat analyses for each lot of steel furnished certifying that the steel conforms to the heat analyses.

2.7.1 Reinforcement Steel Tests

Perform mechanical testing of steel in accordance with ASTM A370 except as otherwise specified or required by the material specifications. Perform tension tests on full cross-section specimens using a gage length that spans the extremities of specimens with welds or sleeves included. From chemical analyses of steel heats report the percentages of carbon, phosphorous, manganese, sulphur and silicon present in the steel.

2.7.2 Non-Destructive Testing of Welds

Perform non-destructive testing of welds in accordance with AWS D1.4/D1.4M Section 7, except that radiographic testing is not permitted.

PART 3 EXECUTION

3.1 REINFORCEMENT

Fabricate and place reinforcement steel and accessories as specified, as indicated, and as shown on approved shop drawings. Fabrication and placement details of steel and accessories not specified or shown mustl be in accordance with ACI SP-66 and ACI 318. Cold bend reinforcement unless otherwise authorized. Bending may be accomplished in the field or at the mill. Do not bend bars after embedment in concrete. Place safety caps on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Face wire tie ends away from the forms. Submit detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Show support details including types, sizes and spacing.

3.1.1 Placement

Reinforcement must be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Place reinforcement in accordance with ACI 318 at locations indicated plus or minus one bar diameter. Do not continue reinforcement through expansion joints and place as indicated through construction or contraction joints. Cover with concrete coverage as indicated or as required by ACI 318. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, requires approval before concrete is placed.

3.1.2 Placing Tolerances

Conform bar spacing and concrete cover to ACI 117.

3.1.3 Splicing

Conform splices of reinforcement to ACI 318 and make only as required or indicated. Bars may be spliced at alternate or additional locations at no additional cost to the Government subject to approval. Splicing must be by lapping or by mechanical or welded butt connection; except that lap splices must not be used for bars larger than No. 11 unless otherwise indicated.

3.1.3.1 Lap Splices

Place lapped bars in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Do not space lapped bars farther apart than 1/5 the required length of lap or 6 inches.

3.1.3.2 Butt-Splices

Use butt-splices only for splicing size 14 and 18 bars and for splicing #11 bars to larger bars except where otherwise shown or authorized. Make butt-splices by a method which develops splices suitable for tension, compression and stress reversal applications. Butt-splices must develop 90 percent of the specified minimum ultimate tensile strength of the smallest bar of each splice. Clean bars of all oil, grease, dirt, rust, scale and other foreign substances and flame dry before splicing. Provide jigs and clamps or other devices to support, align and hold the longitudinal centerline of the bars to be butt-spliced in a straight line. Submit proposed procedure for butt-splicing steel bars prior to making the test butt-splices for qualification of the procedure. Include properties and analyses of steel bars and splicing materials in the submitted procedure. Report physical properties of splicing sleeves to include length, inside and outside diameters, and inside surface details.

3.1.3.2.1 Mechanical Butt-Splices

Fabricate mechanical butt-splices in accordance with the mechanical splicing device manufacturer's recommendations. Bars to be spliced by a mechanical butt-splicing process may be sawed, sheared or flame cut provided the ends of sheared bars are reshaped after shearing and all slag is removed from the ends of flame cut bars by chipping and wire brushing prior to splicing. Clean surfaces to be enclosed within a splice sleeve or coupling by wire brushing or other approved method prior to splicing. Make splices using manufacturer's standard jigs, clamps, ignition devices and other required accessories. Longitudinally stagger tension splices of number 14 or smaller bar a minimum of 5 feet or as otherwise indicated so that no more than half of the bars are spliced at any one section. Longitudinally stagger tension splices of number 18 bars a minimum of 5 feet so that no more than 1/3 of the bars are spliced at any one section.

3.2 WELDED-WIRE REINFORCEMENT PLACEMENT

Place welded-wire reinforcement in slabs as indicated. Reinforcement placed in slabs on grade must be continuous between expansion, construction, and contraction joints. Reinforcement placement at joints must be as indicated.

May lap splices in such a way that the overlapped area equals the distance between the outermost crosswires plus 2 inches. Stagger laps to avoid continuous laps in either direction. Wire or clip together reinforcement at laps at intervals not to exceed 4 feet. Position reinforcement by the use of supports.

3.3 DOWEL INSTALLATION

Install dowels in slabs on grade at locations indicated and at right angles to joint being doweled. Accurately position and align dowels parallel to the finished concrete surface before concrete placement. Rigidly support dowels during concrete placement. Coat one end of dowels with a bond breaker.

3.4 FIELD TESTS AND INSPECTIONS

3.4.1 Identification of Splices

Establish and maintain an approved method of identification of all field butt-splices which will indicate the splicer and the number assigned each splice made by the splicer.

3.4.2 Examining, Testing, and Correcting

Perform the following during the butt-splicing operations as specified and as directed:

3.4.2.1 Visual Examination

Visually examine all welded splices as required by AWS D1.4/D1.4M. Respliced connections resulting from correction of visual defects may be examined by non-destructive testing at the option of the Contracting Officer as specified in paragraph SUPPLEMENTAL EXAMINATION. Visually examine exothermic mechanical butt-splices to determine if the filler metal is clearly visible at the tap holes and completely fills the sleeves at both ends except for spaces of not more than 3/8 inch occupied by packing.

3.4.2.2 Tension Tests

Perform tensions tests to 90 percent of the minimum specified ultimate tensile strength of the spliced bars or to destruction on one test specimen made in the field for every 25 splices made. Test specimens must be made by the splicers engaged in the work, using the approved splicing procedure and the same size bars placed in the same relative position, and under the same conditions as those in the groups represented by the specimens. Furnish stress-strain curves for each butt-splice tested.

3.4.2.3 Non-destructive Testing of Welded Splices

Examine not less than one of each 25 welded splices selected at random by the Contracting Officer by non-destructive testing and evaluate for defects in accordance with AWS D1.4/D1.4M Section 7, except that radiographic testing is not permitted.

3.4.2.4 Correction of Deficiencies

Do not embed splice in concrete until satisfactory results of visual examination and the required tests or examinations have been obtained. Remove all splices having visible defects or represented by test specimens

which do not satisfy the tests or examinations. If any of the tension test specimens fail to meet the strength requirements or deformation limitations cut out two production splices from the same lot represented by the test specimens which failed and tension test. If both of the retests pass the strength requirements and deformation limitations all of the splices in the lot will be accepted. If one or both of the retests fail to meet the strength requirements or deformation limitations all of the splices in the lot will be rejected. Cut off the bars of rejected splices outside the splice zone of weld metal, filler metal contact, coupling or sleeve. Finish the cut ends as specified, resplice and reinspect the joints.

3.4.2.5 Supplemental Examination

The Contracting Officer may require additional or supplemental non-destructive testing and/or tension test of any completed splice.

-- End of Section --

SECTION 03 30 00

CAST-IN-PLACE CONCRETE
05/14

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 121R	(2008) Guide for Concrete Construction Quality Systems in Conformance with ISO 9001
ACI 211.1	(1991; R 2009) Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
ACI 211.2	(1998; R 2004) Standard Practice for Selecting Proportions for Structural Lightweight Concrete
ACI 301	(2016) Specifications for Structural Concrete
ACI 302.1R	(2015) Guide for Concrete Floor and Slab Construction
ACI 304.2R	(2017) Guide to Placing Concrete by Pumping Methods
ACI 304R	(2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	(2010) Guide to Hot Weather Concreting
ACI 306.1	(1990; R 2002) Standard Specification for Cold Weather Concreting
ACI 306R	(2016) Guide to Cold Weather Concreting
ACI 308.1	(2011) Specification for Curing Concrete
ACI 318	(2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)
ACI 347R	(2014; Errata 1 2017) Guide to Formwork

	for Concrete
ACI SP-15	(2011) Field Reference Manual: Standard Specifications for Structural Concrete ACI 301-05 with Selected ACI References
ACI SP-2	(2007; Abstract: 10th Edition) ACI Manual of Concrete Inspection
ACI SP-66	(2004) ACI Detailing Manual

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4	(1995; R 2004) Basic Hardboard

ASTM INTERNATIONAL (ASTM)

ASTM A615/A615M	(2016) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A934/A934M	(2016) Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM C1017/C1017M	(2013; E 2015) Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1077	(2017) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1157/C1157M	(2017) Standard Performance Specification for Hydraulic Cement
ASTM C1260	(2014) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C138/C138M	(2017a) Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C143/C143M	(2015a) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2018) Standard Specification for Portland Cement
ASTM C1602/C1602M	(2012) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C192/C192M	(2016a) Standard Practice for Making and

	Curing Concrete Test Specimens in the Laboratory
ASTM C295/C295M	(2012) Petrographic Examination of Aggregates for Concrete
ASTM C31/C31M	(2018a) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C311/C311M	(2017) Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2018) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C42/C42M	(2013) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C494/C494M	(2017) Standard Specification for Chemical Admixtures for Concrete
ASTM C567/C567M	(2014) Determining Density of Structural Lightweight Concrete
ASTM C595/C595M	(2017) Standard Specification for Blended Hydraulic Cements
ASTM C618	(2017a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C78/C78M	(2018) Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C94/C94M	(2017a) Standard Specification for Ready-Mixed Concrete
ASTM C989/C989M	(2017) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM D1751	(2004; E 2013; R 2013) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2004a; R 2013) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion

ASTM D3665	(2012; R 2017) Standard Practice for Random Sampling of Construction Materials
ASTM D5759	(2012) Characterization of Coal Fly Ash and Clean Coal Combustion Fly Ash for Potential Uses
ASTM D6690	(2015) Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ASTM E329	(2018) Standard Specification for Agencies Engaged in Construction Inspection, Testing or Special Inspection

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 10MSP	(2009; 28th Ed; Errata) Manual of Standard Practice

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST PS 1	(2009) DOC Voluntary Product Standard PS 1-07, Structural Plywood

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Concrete Curing Plan

Quality Control Plan; G

Quality Control Personnel Certifications

Quality Control Organizational Chart

Laboratory Accreditation; G

Form Removal Schedule; G
Construction Material: G

Concrete Random Sampling Plan; G

SD-02 Shop Drawings

Formwork

Reinforcing Steel

SD-03 Product Data

Joint Sealants

Joint Filler

Materials for Forms

Cementitious Materials

Concrete Curing Materials

Reinforcement

Admixtures

SD-05 Design Data

Concrete Mix Design

SD-06 Test Reports

Concrete Mix Design

Fly Ash

Pozzolan

Ground Granulated Blast-Furnace Slag

Aggregates

Compressive Strength Tests

Unit Weight of Structural Concrete

Slump Tests

Water

SD-07 Certificates

Reinforcing Bars

Field Testing Technician and Testing Agency

SD-08 Manufacturer's Instructions

Curing Compound

1.3 MODIFICATION OF REFERENCES

Accomplish work in accordance with ACI publications except as modified herein. Consider the advisory or recommended provisions to be mandatory. Interpret reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" to mean the Contracting Officer.

1.4 DELIVERY, STORAGE, AND HANDLING

Follow ACI 301, ACI 304R and ASTM A934/A934M requirements and

recommendations. Do not deliver concrete until forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. Do not store concrete curing compounds or sealers with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions. Do not store concrete curing compounds or sealers in occupied spaces.

1.4.1 Reinforcement

Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Ensure bar sizes can be accurately identified after bundles are broken and tags removed.

1.5 QUALITY ASSURANCE

1.5.1 Design Data

1.5.1.1 Concrete Mix Design

Sixty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Submit a complete list of materials including type; brand; source and amount of cement, complementary cementitious materials, and admixtures; and applicable reference specifications. Submit mill test and all other test for cement, complementary cementitious materials, aggregates, and admixtures. Provide documentation of maximum nominal aggregate size, gradation analysis, percentage retained and passing sieve, and a graph of percentage retained verses sieve size. Provide mix proportion data using at least three different water-cementitious material ratios for each type of mixture, which produce a range of strength encompassing those required for each type of concrete required. If source material changes, resubmit mix proportion data using revised source material. Provide only materials that have been proven by trial mix studies to meet the requirements of this specification, unless otherwise approved in writing by the Contracting Officer. Indicate clearly in the submittal where each mix design is used when more than one mix design is submitted. Resubmit data on concrete components if the qualities or source of components changes. For previously approved concrete mix designs used within the past twelve months, the previous mix design may be re-submitted without further trial batch testing if accompanied by material test data conducted within the last six months. Obtain mix design approval from the contracting officer prior to concrete placement.

1.5.2 Shop Drawings

1.5.2.1 Reinforcing Steel

ACI SP-66. Indicate bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing bars. Reproductions of contract drawings are unacceptable.

1.5.3 Control Submittals

1.5.3.1 Concrete Curing Plan

Submit proposed materials, methods and duration for curing concrete

elements in accordance with ACI 308.1.

1.5.3.2 Safety Data Sheets

Submit Safety Data Sheets (SDS) for all materials that are regulated for hazardous health effects. SDS must be readily accessible during each work shift to employees when they are at the construction site.

1.5.4 Test Reports

1.5.4.1 Fly Ash and Pozzolan

Submit test results in accordance with ASTM C618 for fly ash and pozzolan. Submit test results performed within 6 months of submittal date.

1.5.4.2 Ground Granulated Blast-Furnace Slag

Submit test results in accordance with ASTM C989/C989M for ground granulated blast-furnace slag. Submit test results performed within 6 months of submittal date.

1.5.4.3 Aggregates

ASTM C1260 for potential alkali-silica reactions, ASTM C295/C295M for petrographic analysis.

1.5.5 Quality Control Plan

Develop and submit for approval a concrete quality control program in accordance with the guidelines of ACI 121R and as specified herein. The plan must include approved laboratories. Provide direct oversight for the concrete qualification program inclusive of associated sampling and testing. All quality control reports must be provided to the Contracting Officer, Quality Manager and Concrete Supplier. Maintain a copy of ACI SP-15 and CRSI 10MSP at project site.

1.5.6 Quality Control Personnel Certifications

The Contractor must submit for approval the responsibilities of the various quality control personnel, including the names and qualifications of the individuals in those positions and a quality control organizational chart defining the quality control hierarchy and the responsibility of the various positions. Quality control personnel must be employed by the Contractor. The Contractor shall develop and submit for acceptance a materials and concrete sampling plan that conforms to ASTM D3665.

Submit American Concrete Institute certification for the following:

a. CQC personnel responsible for inspection of concrete operations.

b. Lead Foreman or Journeyman of the Concrete Placing, Finishing, and Curing Crews.

c. Field Testing Technicians: ACI Concrete Field Testing Technician, Grade I.

1.5.6.1 Quality Manager Qualifications

The quality manager must hold a current license as a professional engineer

in a U.S. state or territory with experience on at least five (5) similar projects. Evidence of extraordinary proven experience may be considered by the Contracting Officer as sufficient to act as the Quality Manager.

1.5.6.2 Field Testing Technician and Testing Agency

Submit data on qualifications of proposed testing agency and technicians for approval by the Contracting Officer prior to performing testing on concrete.

a. Work on concrete under this contract must be performed by an ACI Concrete Field Testing Technician Grade 1 qualified in accordance with ACI SP-2 or equivalent. Equivalent certification programs must include requirements for written and performance examinations as stipulated in ACI SP-2.

b. Testing agencies that perform testing services on reinforcing steel must meet the requirements of ASTM E329.

c. Testing agencies that perform testing services on concrete materials must meet the requirements of ASTM C1077.

1.5.7 Laboratory Qualifications for Concrete Qualification Testing

The concrete testing laboratory must have the necessary equipment and experience to accomplish required testing. The laboratory must meet the requirements of ASTM C1077 and be Cement and Concrete Reference Laboratory (CCRL) inspected.

1.5.8 Laboratory Accreditation

Laboratory and testing facilities must be provided by and at the expense of the Contractor. The laboratories performing the tests must be accredited in accordance with ASTM C1077, including ASTM C78/C78M and ASTM C1260. The accreditation must be current and must include the required test methods, as specified. Furthermore, the testing must comply with the following requirements:

a. Aggregate Testing and Mix Proportioning: Aggregate testing and mixture proportioning studies must be performed by an accredited laboratory and under the direction of a registered professional engineer in a U.S. state or territory competent in concrete materials who is competent in concrete materials and must sign all reports and designs.

b. Acceptance Testing: Furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory. Furnish and maintain boxes or other facilities suitable for storing and curing the specimens at the site while in the mold within the temperature range stipulated by ASTM C31/C31M.

c. Contractor Quality Control: All sampling and testing must be performed by an approved, onsite, independent, accredited laboratory.

PART 2 PRODUCTS

2.1 MATERIALS FOR FORMS

Provide wood, plywood, or steel. Use plywood or steel forms where a smooth

form finish is required.

2.1.1 Wood Forms

Provide lumber that is square edged or tongue-and-groove boards, free of raised grain, knotholes, or other surface defects. Provide plywood that complies with NIST PS 1, B-B concrete form panels or better or AHA A135.4, hardboard for smooth form lining. Submit data verifying that composite wood products contain no urea formaldehyde resins. Virgin wood used must be FSC-certified.

2.1.1.1 Concrete Form Plywood (Standard Rough)

Provide plywood that conforms to NIST PS 1, B-B, concrete form, not less than 5/8-inch thick.

2.1.1.2 Overlaid Concrete Form Plywood (Standard Smooth)

Provide plywood that conforms to NIST PS 1, B-B, high density form overlay, not less than 5/8-inch thick.

2.1.2 Steel Forms

Provide steel form surfaces that do not contain irregularities, dents, or sags.

2.2 FORM TIES AND ACCESSORIES

Provide a form tie system that does not leave mild steel after break-off or removal any closer than 2 inches from the exposed surface. Do not use wire alone. Form ties and accessories must not reduce the effective cover of the reinforcement.

2.2.1 Dovetail Anchor Slot

Preformed metal slot approximately 1 inch by 1 inch of not less than 22 gage galvanized steel cast in concrete. Coordinate actual size and throat opening with dovetail anchors and provide with removable filler material.

2.3 CONCRETE MIX DESIGN

2.3.1 Contractor-Furnished Mix Design

ACI 211.1, ACI 301, and ACI 211.2 except as otherwise specified. Indicate the compressive strength (f'c) of the concrete for each portion of the structure(s) as specified below. Where faster set time is required, use Type III cement before using calcium chloride with approval from the contracting officer.

2.3.1.1 All Project Concrete

Proportion normal-weight concrete mixture as follows:

a. Minimum Compressive Strength: 4000 psi at 28 days.

b. Maximum Water-Cementitious Materials Ratio: 0.45.

c. Slump Limit: Between 2-5 inches.

2.3.1.2 Mix Proportions for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified are the responsibility of the Contractor. Base mixture proportions on compressive strength as determined by test specimens fabricated in accordance with ASTM C192/C192M and tested in accordance with ASTM C39/C39M. Samples of all materials used in mixture proportioning studies must be representative of those proposed for use in the project and must be accompanied by the manufacturer's or producer's test report indicating compliance with these specifications. Base trial mixtures having proportions, consistencies, suitable for the work on methodology described in ACI 211.1. In the trial mixture, use at least three different water-cementitious material ratios for each type of mixture, which must produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cementitious material ratio allowed must be based on equivalent water-cementitious material ratio calculations as determined by the conversion from the weight ratio of water to cement plus pozzolan by weight equivalency method. Design laboratory trial mixture for maximum permitted slump and air content. Each combination of material proposed for use must have separate trial mixture, except for accelerator or retarder use can be provided without separate trial mixture. Report the temperature of concrete in each trial batch. For each water-cementitious material ratio, at least three test cylinders for each test age must be made and cured in accordance with ASTM C192/C192M and tested in accordance with ASTM C39/C39M for 7, 28 days. From these results, plot a curve showing the relationship between water-cementitious material ratio and strength for each set of trial mix studies. In addition, plot a curve showing the relationship between 7 and 28 day strengths.

2.3.1.3 Required Average Strength of Mix Design

The selected mixture must produce an average compressive strength exceeding the specified strength by the amount indicated in ACI 301, but may not exceed the specified strength at the same age by more than 20 percent. When a concrete production facility has a record of at least 15 consecutive tests, the standard deviation must be calculated and the required average compressive strength must be determined in accordance with ACI 301.

2.3.2 Ready-Mix Concrete

Provide concrete that meets the requirements of ASTM C94/C94M.

Ready-mixed concrete manufacturer must provide duplicate delivery tickets with each load of concrete delivered. Provide delivery tickets with the following information in addition to that required by ASTM C94/C94M:

Type and brand cement

Cement and complementary cementitious materials content in 94-pound bags per cubic yard of concrete

Maximum size of aggregate

Amount and brand name of admixtures

Total water content expressed by water cementitious material ratio

2.3.3 Concrete Curing Materials

Provide concrete curing material in accordance with ACI 301 Section 5 and ACI 308.1 Section 2. Submit product data for concrete curing compounds. Submit manufactures instructions for placement of curing compound.

2.4 MATERIALS

2.4.1 Cementitious Materials

For exposed concrete, use one manufacturer and one source for each type of cement, ground slag, fly ash, and pozzolan.

2.4.1.1 Fly Ash

ASTM C618, Class F, except that the maximum allowable loss on ignition must not exceed 6 percent. Class F fly ash for use in mitigating Alkali-Silica Reactivity must have a Calcium Oxide (CaO) content of less than 8 percent and a total equivalent alkali content less than 1.5 percent.

Add with cement. Fly ash content must be a minimum of 6 percent by weight of cementitious material, provided the fly ash does not reduce the amount of cement in the concrete mix below the minimum requirements of local building codes. Where the use of fly ash cannot meet the minimum level, provide the maximum amount of fly ash permittable that meets the code requirements for cement content. Report the chemical analysis of the fly ash in accordance with ASTM C311/C311M. Evaluate and classify fly ash in accordance with ASTM D5759.

2.4.1.2 Raw or Calcined Natural Pozzolan

Natural pozzolan must be raw or calcined and conform to ASTM C618, Class N, including the optional requirements for uniformity and effectiveness in controlling Alkali-Silica reaction and must have an ignition loss not exceeding 3 percent. Class N pozzolan for use in mitigating Alkali-Silica Reactivity must have a Calcium Oxide (CaO) content of less than 13 percent and total equivalent alkali content less than 3 percent.

2.4.1.3 Ultra Fine Fly Ash and Ultra Fine Pozzolan

Ultra-Fine Fly Ash (UFFA) and Ultra Fine Pozzolan (UFP) must conform to ASTM C618, Class F or N, and the following additional requirements:

a. The strength activity index at 28 days of age must be at least 95 percent of the control specimens.

b. The average particle size must not exceed 6 microns.

c. The sum of $SiO_2 + Al_2O_3 + Fe_2O_3$ must be greater than 77 percent.

2.4.1.4 Ground Granulated Blast-Furnace Slag

ASTM C989/C989M, Grade 120. Slag content must be a minimum of 25 percent by weight of cementitious material.

2.4.1.5 Portland Cement

Provide cement that conforms to ASTM C150/C150M, Type I with tri-calcium aluminates (C3A) content less than 10 percent and a maximum cement-alkali

content of 0.80 percent Na2Oe (sodium oxide) equivalent. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.

2.4.1.6 Blended Cements

Blended cement must conform to ASTM C595/C595M and ASTM C1157/C1157M, Type IP or IS, including the optional requirement for mortar expansion and sulfate soundness and consist of a mixture of ASTM C150/C150M Type I, or Type II cement and a complementary cementing material. The slag added to the Type IS blend must be ASTM C989/C989M ground granulated blast-furnace slag. The pozzolan added to the Type IP blend must be ASTM C618 Class F and must be interground with the cement clinker. The manufacturer must state in writing that the amount of pozzolan in the finished cement will not vary more than plus or minus 5 mass percent of the finished cement from lot-to-lot or within a lot. The percentage and type of mineral admixture used in the blend must not change from that submitted for the aggregate evaluation and mixture proportioning.

2.4.2 Water for Concrete and Curing

Water must comply with the requirements of ASTM C1602/C1602M. Minimize the amount of water in the mix. Improve workability by adjusting the grading rather than by adding water. Water must be potable; free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances deleterious to concrete. Submit test report showing water complies with ASTM C1602/C1602M.

2.4.3 Aggregates

ASTM C33/C33M, except as modified herein. Furnish aggregates for exposed concrete surfaces from one source. Provide aggregates that do not contain any substance which may be deleteriously reactive with the alkalies in the cement. Submit test report showing compliance with ASTM C33/C33M.

2.4.4 Admixtures

ASTM C494/C494M: Type A, water reducing; Type B, retarding; Type C, accelerating; Type D, water-reducing and retarding; and Type E, water-reducing and accelerating admixture. Do not use calcium chloride admixtures. Submit product data for admixtures used in concrete.

2.4.4.1 High Range Water Reducer (HRWR) (Superplasticizers)

ASTM C494/C494M, Type F and ASTM C1017/C1017M.

2.4.5 Expansion/Contraction Joint Filler

ASTM D1751 or ASTM D1752 Type I or II. Material must be 1/2 inch thick, unless otherwise indicated.

2.4.6 Joint Sealants

Submit manufacturer's product data, indicating VOC content.

2.4.6.1 Horizontal Surfaces, 3 Percent Slope, Maximum

ASTM D6690 or ASTM C920, Type M, Class 25, Use T.

2.4.6.2 Vertical Surfaces Greater Than 3 Percent Slope

ASTM C920, Type M, Grade NS, Class 25, Use T.

2.5 REINFORCEMENT

2.5.1 Reinforcing Bars

ACI 301 unless otherwise specified. ASTM A615/A615M with the bars marked A, Grade 60. Submit mill certificates for reinforcing bars attesting furnished steel contains no less than 25 percent recycled scrap steel and meets the requirements specified herein prior to the installation of reinforcing steel.

2.5.2 Reinforcing Bar Supports

Supports include bolsters, chairs, spacers, and other devices necessary for proper spacing, supporting, and fastening reinforcing bars in place.

Provide wire bar type supports of coated or non-corrodible material conforming to ACI SP-66 and CRSI 10MSP.

2.5.3 TESTS, INSPECTIONS, AND VERIFICATIONS

Perform material tests, specified and required by applicable standards, by an approved laboratory and certified to demonstrate that the materials are in conformance with the specifications. Perform and certify tests, inspections, and verifications and certify. Submit certified tests reports of reinforcement steel showing that the steel complies with the applicable specifications for each steel shipment and identified with specific lots prior to placement. Submit three copies of the heat analyses for each lot of steel furnished certifying that the steel conforms to the heat analyses.

Perform mechanical testing of steel in accordance with ASTM A370 except as otherwise specified or required by the material specifications. Perform tension tests on full cross-section specimens using a gage length that spans the extremities of specimens with welds or sleeves included. From chemical analyses of steel heats report the percentages of carbon, phosphorous, manganese, sulphur and silicon present in the steel.

PART 3 EXECUTION

3.1 EXAMINATION

Do not begin installation until substrates have been properly constructed; verify that substrates are level.

If substrate preparation is the responsibility of another installer, notify Contracting Officer of unsatisfactory preparation before processing.

Check field dimensions before beginning installation. If dimensions vary too much from design dimensions for proper installation, notify Contracting Officer and wait for instructions before beginning installation.

3.2 PREPARATION

Determine quantity of concrete needed and minimize the production of excess concrete. Designate locations or uses for potential excess concrete before the concrete is poured.

3.2.1 General

Surfaces against which concrete is to be placed must be free of debris, loose material, standing water, snow, ice, and other deleterious substances before start of concrete placing.

Remove standing water without washing over freshly deposited concrete. Divert flow of water through side drains provided for such purpose.

3.2.2 Subgrade Under Slabs on Ground

Before construction of slabs on ground, have underground work on pipes and conduits completed and approved.

Previously constructed subgrade or fill must be cleaned of foreign materials.

Finish surface of capillary water barrier under interior slabs on ground must not show deviation in excess of 1/4 inch when tested with a 10-foot straightedge parallel with and at right angles to building lines.

Finished surface of subgrade or fill under exterior slabs on ground must not be more than 0.02-foot above or 0.10-foot below elevation indicated.

3.2.3 Edge Forms and Screed Strips for Slabs

Set edge forms or bulkheads and intermediate screed strips for slabs to obtain indicated elevations and contours in finished slab surface and must be strong enough to support vibrating bridge screeds or roller pipe screeds if nature of specified slab finish requires use of such equipment. Align concrete surface to elevation of screed strips by use of strike-off templates or approved compacting-type screeds.

3.2.4 Reinforcement and Other Embedded Items

Secure reinforcement, joint materials, and other embedded materials in position, inspected, and approved before start of concrete placing.

3.3 FORMS

Provide forms, shoring, and scaffolding for concrete placement in accordance with ACI 301 Section 2 and 5 and ACI 347R. Set forms mortar-tight and true to line and grade. Chamfer above grade exposed joints, edges, and external corners of concrete 0.75 inch unless otherwise indicated. Provide formwork with clean-out openings to permit inspection and removal of debris.

3.3.1 Coating

Before concrete placement, coat the contact surfaces of forms with a form release agent.

3.3.2 Reshoring

Reshore concrete elements in accordance with ACI 301 Section 2.

3.3.3 Reuse

Reuse forms providing the structural integrity of concrete and the aesthetics of exposed concrete are not compromised. Wood forms must not be clogged with paste and must be capable of absorbing high water-cementitious material ratio paste.

3.3.4 Forms for Standard Smooth Form Finish

Provide formwork in accordance with ACI 301 Section 5 with a surface finish, SF-3.0, for formed surfaces that are exposed to view.

3.3.5 Form Ties

Provide ties in accordance with ACI 301 section 2.

3.3.6 Tolerances for Form Construction

Construct formwork to ensure that after removal of forms and prior to patching and finishing of formed surfaces, provide concrete surfaces in accordance with tolerances specified in ACI 301 Section 5 and ACI 117.

3.3.7 Removal of Forms and Supports

After placing concrete, removal of forms must be in accordance with ACI 301 Section 2 except as modified by approved form removal schedule.

3.4 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

ACI 301 and ACI SP-66. Provide bars, welded wire reinforcement, wire ties, supports, and other devices necessary to install and secure reinforcement. Reinforcement must not have rust, scale, oil, grease, clay, or foreign substances that would reduce the bond. Rusting of reinforcement is a basis of rejection if the effective cross-sectional area or the nominal weight per unit length has been reduced. Remove loose rust prior to placing steel. Tack welding is prohibited.

3.4.1 General

Provide details of reinforcement that are in accordance with ACI 301 and ACI SP-66 and as specified.

3.4.2 Reinforcement Supports

Support reinforcement in accordance with ACI 301 Section 3. Supports for coated or galvanized bars must also be coated with electrically compatible material for a distance of at least 2 inches beyond the point of contact with the bars.

3.4.3 Splicing

As indicated. For splices not indicated ACI 301. Do not splice at points of maximum stress.

3.4.4 Setting Miscellaneous Material

Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement and support against displacement. Plumb anchor bolts and check location and elevation.

Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.

3.4.5 Fabrication

Shop fabricate reinforcing bars to conform to shapes and dimensions indicated for reinforcement, and as follows:

Provide fabrication tolerances that are in accordance with ACI 318 and ACI SP-66.

Provide hooks and bends that are in accordance with ACI 318 and ACI SP-66.

Reinforcement must be bent cold to shapes as indicated. Bending must be done in the shop. Re-bending of a reinforcing bar that has been bent incorrectly is not be permitted. Bending must be in accordance with standard approved practice and by approved machine methods.

Tolerance on nominally square-cut, reinforcing bar ends must be in accordance with ACI SP-66.

Deliver reinforcing bars bundled, tagged, and marked. Tags must be metal with bar size, length, mark, and other information pressed in by machine. Marks must correspond with those used on the placing drawings.

Do not use reinforcement that has any of the following defects:

a. Bar lengths, depths, and bends beyond specified fabrication tolerances

b. Bends or kinks not indicated on drawings or approved shop drawings

c. Bars with reduced cross-section due to rusting or other cause

Replace defective reinforcement with new reinforcement having required shape, form, and cross-section area.

3.4.6 Placing Reinforcement

Place reinforcement in accordance with ACI 301 and ACI SP-66.

For slabs on grade (over earth or over capillary water barrier) and for footing reinforcement, support bars or welded wire reinforcement on precast concrete blocks, spaced at intervals required by size of reinforcement, to keep reinforcement the minimum height specified above the underside of slab or footing.

Provide reinforcement that is supported and secured together to prevent displacement by construction loads or by placing of wet concrete, and as follows:

Provide supports for reinforcing bars that are sufficient in number and have sufficient strength to carry the reinforcement they support, and in accordance with ACI 318, ACI SP-66 and CRSI 10MSP. Do not use supports to support runways for concrete conveying equipment and similar construction loads.

Equip supports on ground and similar surfaces with sand-plates.

Support welded wire reinforcement as required for reinforcing bars.

Secure reinforcements to supports by means of tie wire. Wire must be black, soft iron wire, not less than 16 gage.

Reinforcement must be accurately placed, securely tied at intersections, and held in position during placing of concrete by spacers, chairs, or other approved supports. Point wire-tie ends away from the form. Unless otherwise indicated, numbers, type, and spacing of supports must conform to ACI SP-66.

Bending of reinforcing bars partially embedded in concrete is permitted only as specified in ACI SP-66 and ACI 318.

3.4.7 Spacing of Reinforcing Bars

Spacing must be as indicated. If not indicated, spacing must be in accordance with the ACI 318 and ACI SP-66.

Reinforcing bars may be relocated to avoid interference with other reinforcement, or with conduit, pipe, or other embedded items. If any reinforcing bar is moved a distance exceeding one bar diameter or specified placing tolerance, resulting rearrangement of reinforcement is subject to preapproval by the Contracting Officer.

3.4.8 Concrete Protection for Reinforcement

Concrete protection must be in accordance with the ACI 318 and ACI SP-66.

3.4.9 Welding

Welding is not allowed, unless approved by the Contracting Officer.

3.5 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

ASTM C94/C94M, ACI 301, ACI 302.1R and ACI 304R, except as modified herein. Batching equipment must be such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish mandatory batch ticket information for each load of ready mix concrete.

3.5.1 Measuring

Make measurements at intervals as specified in paragraphs SAMPLING and TESTING.

3.5.2 Mixing

ASTM C94/C94M, ACI 301 and ACI 304R. Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 84 degrees F. Reduce mixing time and place concrete within 60 minutes if the air temperature is greater than 84 degrees F except as follows: if set retarding admixture is used and slump requirements can be met, limit for placing concrete may remain at 90 minutes. Additional water may be added, provided that both the specified maximum slump and water-cementitious material ratio are not exceeded, and the required concrete strength is still met. When additional water is added, an additional 30 revolutions of the mixer at mixing speed is required.

Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch. Do not reconstitute concrete that has begun to solidify.

3.5.3 Transporting

Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete which has segregated in transporting and dispose of as directed.

3.6 PLACING CONCRETE

Place concrete in accordance with ACI 301 Section 5. The only persons authorized to add water to the concrete truck at the job site are the QC lab testing representative and the COR. If authorized by the QC lab testing representative; he shall notify the COR and QA testing representative.

3.6.1 Pumping

ACI 304R and ACI 304.2R. Pumping must not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment must not exceed 2 inches at discharge/placement. Do not convey concrete through pipe made of aluminum or aluminum alloy. Avoid rapid changes in pipe sizes. Limit maximum size of course aggregate to 33 percent of the diameter of the pipe. Limit maximum size of well-rounded aggregate to 40 percent of the pipe diameter. Take samples for testing at both the point of delivery to the pump and at the discharge end.

3.6.2 Cold Weather

ACI 306.1. Do not allow concrete temperature to decrease below 50 degrees F. Obtain approval prior to placing concrete when the ambient temperature is below 40 degrees F or when concrete is likely to be subjected to freezing temperatures within 24 hours. Cover concrete and provide sufficient heat to maintain 50 degrees F minimum adjacent to both the formwork and the structure while curing. Limit the rate of cooling to 37 degrees F in any 1 hour and 50 degrees F per 24 hours after heat application.

3.6.3 Hot Weather

Maintain required concrete temperature using Figure 4.2 in ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

3.6.4 Bonding

Surfaces of set concrete at joints, must be roughened and cleaned of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner that exposes the aggregate uniformly and does not leave laitance, loosened particles of aggregate, nor damaged concrete at the surface.

Obtain bonding of fresh concrete that has set as follows:

a. At joints between footings and walls or columns, between walls or columns and the beams or slabs they support, and elsewhere unless otherwise specified; roughened and cleaned surface of set concrete must be dampened, but not saturated, immediately prior to placing of fresh concrete.

b. At joints in exposed-to-view work; at vertical joints in walls; at joints near midpoint of span in girders, beams, supported slabs, other structural members; in work designed to contain liquids; the roughened and cleaned surface of set concrete must be dampened but not saturated and covered with a cement grout coating.

c. Provide cement grout that consists of equal parts of portland cement and fine aggregate by weight with not more than 6 gallons of water per sack of cement. Apply cement grout with a stiff broom or brush to a minimum thickness of 1/16 inch. Deposit fresh concrete before cement grout has attained its initial set.

3.7 WASTE MANAGEMENT

Provide as specified in the Waste Management Plan and as follows.

3.7.1 Mixing Equipment

Before concrete pours, designate on-site area to be paved later in project for cleaning out concrete mixing trucks. Minimize water used to wash equipment.

3.7.2 Hardened, Cured Waste Concrete

Dispose of hardened, cured waste concrete using contractor's preapproved waste management methods and facilities.

3.7.3 Reinforcing Steel

Collect reinforcing steel and place in designated area for recycling.

3.7.4 Other Waste

Identify concrete manufacturer's or supplier's policy for collection or return of construction waste, unused material, deconstruction waste, and/or packaging material.

3.8 SURFACE FINISHES EXCEPT FLOOR, SLAB, AND PAVEMENT FINISHES

3.8.1 Defects

Repair surface defects in accordance with ACI 301 Section 5.

3.8.2 Formed Surfaces

3.8.2.1 Tolerances

ACI 117 and as indicated.

3.8.2.2 Standard Smooth Finish

Provide for surfaces exposed to public view a surface finish SF-3.0. Patch holes and defects in accordance with ACI 301.

3.9 SLAB, AND PAVEMENT FINISHES AND MISCELLANEOUS CONSTRUCTION

ACI 301 and ACI 302.1R, unless otherwise specified.

3.9.1 Finish

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleed water appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleed water is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleed water.

3.9.1.1 Nonslip Finish

Use on surfaces except slabs on grade. Finish concrete with a troweled finish left slightly rough with no divots or projections greater than 1/8 inch.

3.9.1.2 Broomed

Use on surfaces of exterior walks, platforms, patios, and ramps, unless otherwise indicated. Finish concrete in accordance with ACI 301 Section 5 for a broomed finish.

3.9.1.3 Pavement

Screed the concrete with a template advanced with a combined longitudinal and crosswise motion. Maintain a slight surplus of concrete ahead of the template. After screeding, float the concrete longitudinally. Use a straightedge to check slope and flatness; correct and refloat as necessary. Obtain final finish by brooming according to section 3.10.1.6. Round edges and joints with an edger having a radius of 1/8 inch.

3.9.2 Flat Floor Finishes

3.9.2.1 Remedies for Out of Tolerance Work

Contractor is required to repair and retest any floors not meeting specified tolerances. Prior to repair, Contractor must submit and receive approval for the proposed repair, including product data from any materials proposed. Repairs must not result in damage to structural integrity of the floor. For floors exposed to public view, repairs must prevent any uneven or unusual coloring of the surface.

3.10 JOINTS

3.10.1 Construction Joints

Make and locate joints not indicated so as not to impair strength and appearance of the structure, as approved. Joints must be perpendicular to main reinforcement. Reinforcement must be continued and developed across construction joints. Locate construction joints as follows:

3.10.1.1 Maximum Allowable Construction Joint Spacing

a. In walls at not more than 60 feet in any horizontal direction.

b. In slabs on ground, so as to divide slab into areas not in excess of 1,200 square feet.

3.10.1.2 Construction Joints for Constructability Purposes

a. In walls, at top of footing; at top of slabs on ground; at top and bottom of door and window openings or where required to conform to architectural details; and at underside of deepest beam or girder framing into wall.

b. In columns or piers, at top of footing; at top of slabs on ground; and at underside of deepest beam or girder framing into column or pier.

c. Near midpoint of spans for supported slabs, beams, and girders unless a beam intersects a girder at the center, in which case construction joints in girder must offset a distance equal to twice the width of the beam. Make transfer of shear through construction joint by use of inclined reinforcement.

Provide keyways at least 1-1/2-inches deep in construction joints in walls and slabs and between walls and footings; approved bulkheads may be used for slabs.

3.10.2 Isolation Joints in Slabs on Ground

Provide joints at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

Fill joints with premolded joint filler strips 1/2 inch thick, extending full slab depth. Install filler strips at proper level below finish floor elevation with a slightly tapered, dress-and-oiled wood strip temporarily secured to top of filler strip to form a groove not less than 3/4 inch in depth where joint is sealed with sealing compound and not less than 1/4 inch in depth where joint sealing is not required. Remove wood strip after concrete has set. Contractor must clean groove of foreign matter and loose particles after surface has dried.

3.10.3 Contraction Joints in Slabs on Ground

Provide joints to form panels as indicated.

Under and on exact line of each control joint, cut 50 percent of welded wire reinforcement before placing concrete.

Sawcut contraction joints into slab on ground in accordance with ACI 301

Section 5.

Joints must be 1/8-inch wide by 1/5 to 1/4 of slab depth and formed by inserting hand-pressed fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. After concrete has cured for at least 7 days, the Contractor must remove inserts and clean groove of foreign matter and loose particles.

Sawcutting will be limited to within 12 hours after set and at 1/4 slab depth.

3.10.4 Sealing Joints in Slabs on Ground

Contraction and control joints which are to receive finish flooring material must be sealed with joint sealing compound after concrete curing period. Slightly underfill groove with joint sealing compound to prevent extrusion of compound. Remove excess material as soon after sealing as possible.

Sealed groove must be left ready to receive filling material that is provided as part of finish floor covering work.

3.11 CURING AND PROTECTION

ACI 301 Section 5, unless otherwise specified. Begin curing immediately following form removal. Avoid damage to concrete from vibration created by blasting, pile driving, movement of equipment in the vicinity, disturbance of formwork or protruding reinforcement, and any other activity resulting in ground vibrations. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period. Provide moist curing for those areas receiving liquid chemical sealer-hardener or epoxy coating. Allow curing compound/sealer installations to cure prior to the installation of materials that adsorb VOCs.

3.11.1 Requirements for Type III, High-Early-Strength Portland Cement

The curing periods are required to be not less than one-fourth of those specified for portland cement, but in no case less than 72 hours.

3.11.2 Curing Periods

ACI 301 Section 5, except 10 days for retaining walls, pavement or chimneys. Begin curing immediately after placement. Protect concrete from premature drying, excessively hot temperatures, and mechanical injury; and maintain minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing are subject to approval by the Contracting Officer.

3.11.3 Curing Formed Surfaces

Accomplish curing of formed surfaces, including undersurfaces of girders,

beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed before end of curing period, accomplish final curing of formed surfaces by any of the curing methods specified above, as applicable.

3.11.4 Curing Unformed Surfaces

Accomplish initial curing of unformed surfaces, such as monolithic slabs, floor topping, and other flat surfaces, by membrane curing.

Unless otherwise specified, accomplish final curing of unformed surfaces by any of curing methods specified, as applicable.

3.11.5 Temperature of Concrete During Curing

When temperature of atmosphere is 41 degrees F and below, maintain temperature of concrete at not less than 55 degrees F throughout concrete curing period or 45 degrees F when the curing period is measured by maturity. When necessary, make arrangements before start of concrete placing for heating, covering, insulation, or housing as required to maintain specified temperature and moisture conditions for concrete during curing period.

When the temperature of atmosphere is 80 degrees F and above or during other climatic conditions which cause too rapid drying of concrete, make arrangements before start of concrete placing for installation of wind breaks, of shading, and for fog spraying, wet sprinkling, or moisture-retaining covering of light color as required to protect concrete during curing period.

Changes in temperature of concrete must be uniform and not exceed 37 degrees F in any 1 hour nor 80 degrees F in any 24-hour period.

3.11.6 Protection from Mechanical Injury

During curing period, protect concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration and from damage caused by rain or running water.

3.11.7 Protection After Curing

Protect finished concrete surfaces from damage by construction operations.

3.12 FIELD QUALITY CONTROL

3.12.1 Sampling

ASTM C172/C172M. Collect samples of fresh concrete to perform tests specified. ASTM C31/C31M for making test specimens.

3.12.2 Testing

3.12.2.1 Slump Tests

ASTM C143/C143M. Take concrete samples during concrete placement/discharge. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cementitious material ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 20 cubic

yards (maximum) of concrete.

3.12.2.2 Temperature Tests

Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 50 degrees F and above 80 degrees F) for each batch (minimum) or every 20 cubic yards (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.

3.12.2.3 Compressive Strength Tests

ASTM C39/C39M. Make five 4 inch by 8 inch test cylinders for each set of tests in accordance with ASTM C31/C31M, ASTM C172/C172M and applicable requirements of ACI 305R and ACI 306R. Take precautions to prevent evaporation and loss of water from the specimen. Test one cylinder at 7 days, three cylinders at 28 days, and hold one cylinder in reserve. Take samples for strength tests of each mix design of and for concrete placed each day not less than once a day, nor less than once for each 100 cubic yards of concrete for the first 500 cubic yards, then every 500 cubic yards thereafter, nor less than once for each 5400 square feet of surface area for slabs or walls. For the entire project, take no less than five sets of samples and perform strength tests for each mix design of concrete placed. Each strength test result must be the average of three cylinders from the same concrete sample tested at 28 days. Concrete compressive tests must meet the requirements of ACI 318 Section 5.6. Retest locations represented by erratic core strengths. Where retest does not meet concrete compressive strength requirements submit a mitigation or remediation plan for review and approval by the contracting officer. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete.

3.12.2.4 Unit Weight of Structural Concrete

ASTM C567/C567M and ASTM C138/C138M. Determine unit weight of lightweight and normal weight concrete. Perform test for every 20 cubic yards maximum.

3.12.2.5 Strength of Concrete Structure

The strength of the concrete structure will be considered to be deficient if any of the following conditions are identified:

a. Failure to meet compressive strength tests as evaluated

b. Reinforcement not conforming to requirements specified

c. Concrete which differs from required dimensions or location in such a manner as to reduce strength

d. Concrete curing and protection of concrete against extremes of temperature during curing, not conforming to requirements specified

e. Concrete subjected to damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration

f. Poor workmanship likely to result in deficient strength

Where the strength of the concrete structure is considered deficient submit a mitigation or remediation plan for review and approval by the contracting officer.

3.12.2.6 Non-Conforming Materials

Factors that indicate that there are non-conforming materials include (but not limited to) excessive compressive strength, inadequate compressive strength, excessive slump, excessive voids and honeycombing, concrete delivery records that indicate excessive time between mixing and placement, or excessive water was added to the mixture during delivery and placement. Any of these indicators alone are sufficient reason for the Contracting Officer to request additional sampling and testing.

Investigations into non-conforming materials must be conducted at the Contractor's expense. The Contractor must be responsible for the investigation and must make written recommendations to adequately mitigate or remediate the non-conforming material. The Contracting Officer may accept, accept with reduced payment, require mitigation, or require removal and replacement of non-conforming material at no additional cost to the Government.

3.12.2.7 Testing Concrete Structure for Strength

When there is evidence that strength of concrete structure in place does not meet specification requirements or there are non-conforming materials, make cores drilled from hardened concrete for compressive strength determination in accordance with ASTM C42/C42M, and as follows:

a. Take at least three representative cores from each member or area of concrete-in-place that is considered potentially deficient. Location of cores will be determined by the Contracting Officer.

b. Test cores after moisture conditioning in accordance with ASTM C42/C42M if concrete they represent is more than superficially wet under service.

c. Air dry cores, (60 to 80 degrees F with relative humidity less than 60 percent) for 7 days before test and test dry if concrete they represent is dry under service conditions.

d. Strength of cores from each member or area are considered satisfactory if their average is equal to or greater than 85 percent of the 28-day design compressive strength of the class of concrete.

e. Core specimens will be taken and tested by the Government. If the results of core-boring tests indicate that the concrete as placed does not conform to the drawings and specification, the cost of such tests and restoration required must be borne by the Contractor.

Fill core holes solid with patching mortar and finished to match adjacent concrete surfaces.

Correct concrete work that is found inadequate by core tests in a manner approved by the Contracting Officer.

3.13 REPAIR, REHABILITATION AND REMOVAL

Before the Contracting Officer accepts the structure, the Contractor must inspect the structure for cracks, damage and substandard concrete placements that may adversely affect the service life of the structure. A report documenting these defects must be prepared which includes recommendations for repair, removal or remediation must be submitted to the

Contracting Officer for approval before any corrective work is accomplished.

3.13.1 Crack Repair

Prior to final acceptance, all cracks in excess of 0.02 inches wide must be documented and repaired. The proposed method and materials to repair the cracks must be submitted to the Contracting Officer for approval. The proposal must address the amount of movement expected in the crack due to temperature changes and loading.

3.13.2 Repair of Weak Surfaces

Weak surfaces are defined as mortar-rich, rain-damaged, uncured, or containing exposed voids or deleterious materials. Concrete surfaces with weak surfaces less than 1/4 inch thick must be diamond ground to remove the weak surface. Surfaces containing weak surfaces greater than 1/4 inch thick must be removed and replaced or mitigated in a manner acceptable to the Contracting Officer.

3.13.3 Failure of Quality Assurance Test Results

Proposed mitigation efforts by the Contractor must be approved by the Contracting Officer prior to proceeding.

-- End of Section --

SECTION 05 05 23.13 10

ULTRASONIC INSPECTION OF WELDMENTS
05/14

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189	(2016) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel (ANSI/ASNT CP-105-2006)

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel

1.2 DEFINITIONS

1.2.1 A Scan

Method of data presentation on a cathode ray tube using rectangular coordinates in which a horizontal base line indicates elapsed time when reading from left to right. A vertical deflection in the base line indicates reflect signal amplitude.

1.2.2 Acoustically Similar Material

Material the same as that to be inspected; or another material proven to have acoustical velocity within plus or minus 3 percent and an attenuation within plus or minus 0.25 dB/inch of the inspected material for the inspection frequency and wave mode, using the same mode as that to be used for inspection.

1.2.3 Amplitude

When referring to an indication in A scan presentation, amplitude is the vertical height of the indication measured from peak-to-peak for radio frequency indications and trace-to-peak for video indications.

1.2.4 Attenuation

Dissipation or loss of energy as ultrasonic vibrations travel through the material. Attenuation is caused almost entirely by scattering of the ultrasonic vibrations generated by the search unit.

1.2.5 Back Reflection or End Reflection

Reflection from the opposite side, end, or boundary of the material into which the ultrasonic energy was introduced.

1.2.6 Calibration

Process of comparing an instrument or device with a standard to determine accuracy or produce a scale.

1.2.7 Digital Display

Display capable of presenting multi-function a-scan, b-scan, c-scan or s-scan responses. This also includes instruments settings and parameters.

1.2.8 Couplant

Any material, usually a liquid or semiliquid, used between the search unit and the inspection surface to exclude air and to convey the ultrasonic vibrations between the search unit and the material being inspected.

1.2.9 Decibel (dB)

Units for the logarithmic expression of the ratio of power levels. Power levels can be functions of voltage, current, or impedance, for example. Decibel units having no values of their own are only significant when a reference is stated, as 10 dB above one reference level or 6 dB below another reference level.

1.2.10 Discontinuity

Anything within a material that will cause a detectable interruption in an ultrasonic beam.

1.2.11 Examination

Within the context of this specification, examination is equivalent to the word "inspection."

1.2.12 Hertz

One complete set of recurrent values of a periodic quantity comprises a cycle. In other words, any one set of periodic variations starting at one condition and returning once to the same condition is a cycle.

1.2.13 Immersion Techniques

Test methods in which the part to be tested and the search units are immersed in water or other suitable liquid couplant. A mechanical device is used to firmly hold and direct the wave angle of the search unit. The search unit does not contact the item being inspected.

1.2.14 Indication

Visual presentation on the digital display screen resulting from a sound beam reflection from a boundary surface or discontinuity.

1.2.15 Linearity

Property of an instrument revealed by a linear change in reflected signal or displacement. The vertical linearity is determined by plotting the change in ratios of signal amplitude from two adjacent reflections from an area of known size. The horizontal linearity is determined by plotting the

distance the signal is displaced along the sweep against the change in material thickness or by noting the spacing of multiple back reflections.

1.2.16 Longitudinal or Compressional Waves

Simple compression-rare-fraction waves in which particle motion within a material is linear and in the direction of wave propagation. Also called straight beams, or compressional or normal waves.

1.2.17 Longitudinal Wave Inspection

Ultrasonic technique, normally using straight beam methods, in which longitudinal waves are the dominant form.

1.2.18 Mid-Screen Reflection

Reflection whose amplitude is equal to one-half the useable screen height on the digital display.

1.2.19 Megahertz (MHz)

One million hertz per second frequency.

1.2.20 Pulse Repetition Rate

Number of spaced pulses of sound per second sent into the material being inspected.

1.2.21 Reflector

Boundary, consisting of an opposite side, crack, or separation, or a distinct change in material such as slag or porosity that reflects the ultrasonic energy the same as a mirror reflects light.

1.2.22 Refracted Waves

Waves that have undergone change of velocity and direction by passing from one material to another material with different acoustical properties. Refraction will occur wherever the angle of the incident wave to the interface is other than perpendicular.

1.2.23 Resolution

Ability to clearly distinguish signals obtained from two reflective surfaces with a minimum separation distance. Near-surface resolution is the ability to clearly distinguish a signal from a reflector at a minimum distance under the contact or near surface without interference from the initial pulse signal. Far-surface resolution is the ability to clearly distinguish signals from reflectors displaced at minimum distances from the far or back surface when the sound beam is normal to that back surface.

1.2.24 Search Unit

Device containing a piezoelectric material used for introducing vibrations into a material to be inspected or for receiving the vibrations reflected from the material. The active element of the search unit is defined as the effective transmitting area. Search units are also called transducers or probes. They may be single or dual and contain one or two piezoelectric elements, respectively, for transmission and reception. The single search

unit is sometimes enclosed in a transducer wheel or search unit wheel. The search unit may be manually handled and placed in direct contact with the material to be inspected or may be held in a fixture for immersion techniques.

1.2.25 Sensitivity

Measure of the ultrasonic equipment's ability to detect discontinuities. Quantitatively, it is the level of amplification of the receiver circuit in the ultrasonic instrument necessary to produce the required indication on the scope from the reference hole in the reference block. Also see "Standard Reference Level."

1.2.26 Shear Waves

Waves in which the particles within the material vibrate perpendicularly to the direction in which the wave travels or propagates. Also called transverse waves.

1.2.27 Standard Reference Level

Mid-screen height reflection when beaming at the 0.06 inch hole in the primary reference block or the reference hole in the secondary standard.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Ultrasonic Inspection

SD-06 Test Reports

Equipment Qualifications
Inspection Test Reports

1.4 QUALITY ASSURANCE

1.4.1 Personnel Qualification

The three levels of responsibility associated with ultrasonic inspection are defined in ANSI/ASNT CP-189. For qualification to perform ultrasonic inspection, personnel must be certified under ANSI/ASNT CP-189 within a period of 1 year before the date of contract. Other qualification or certification may be accepted at the Contracting Officer's discretion. Personnel with only an operator or inspector trainee certification will not be considered qualified to pass judgment on the acceptability of inspected items, but may work under the direct supervision of a qualified ultrasonic inspector. Qualified ultrasonic inspectors must be able to judge the acceptability of the item in accordance with paragraph ACCEPTANCE/REJECTION LIMITS. Submit a standard reference block and working standards as described in paragraph REFERENCE STANDARDS. The procedures to be used for personnel and equipment qualification, equipment calibration, and inspection, at least 30 days prior to their intended use. Approval by the

Government will in no way affect the obligation of the Contractor to employ qualified personnel, equipment, and procedures, and to perform the inspection as specified.

1.4.2 Examinations

If the Contracting Officer doubts an individual's ability as an operator, inspector, or supervisor, recertify the individual in accordance with ANSI/ASNT CP-189. At the option of the Government, the Contracting Officer may participate in administering the examination and in evaluating the results.

1.4.3 Reference Standards

Use reference standards to calibrate the inspection equipment, test its operating condition, and record the sensitivity or response of the equipment during the inspection in accordance with paragraph EQUIPMENT QUALIFICATION. The standards comprise a standard reference block and reference specimens as noted below.

a. Provide the standard reference block or primary standard consisting of the IIW block in AWS D1.1/D1.1M, Clause 6, Part F. Also use the standard reference block in any reinspection on the same basis as the original inspection, even though the reinspection is to be performed by other ultrasonic instruments and accessories.

b. As an option, use other recognized working standards detailed with the IIW block in AWS D1.1/D1.1M such as the Sensitivity Calibration (SC) block. However, reference such blocks to the IIW block as noted in paragraph SENSITIVITY CALIBRATION. Include details of their use in the submitted procedure description. These blocks are the secondary standards. They must be of acoustically similar material to the welds to be inspected. The secondary standards must be suited for the applicable tests specified in paragraph EQUIPMENT QUALIFICATIONS and are used as follows, except where the IIW block is specifically required:

   (1) To assure adequate penetration of the base material.
   (2) To provide a secondary field standard.
   (3) To calibrate the equipment and establish the standard reference level.

1.4.4 Resolution Test Block

Furnish a resolution test block in accordance with the details shown in AWS D1.1/D1.1M, Clause 6, Part F.

1.4.5 Equipment Qualifications

Evaluate the ultrasonic instrument and accessories on their arrival at the jobsite, immediately prior to the start of inspection, using the primary standard. Qualify and calibrate equipment in accordance with AWS D1.1/D1.1M, Clause 6, Part F. Do not use equipment in the inspection that does not meet these requirements. Submit a copy of test results.

1.4.6 Requalifications

Requalify the equipment after normal use at intervals not to exceed 40 hours, except as noted, and immediately after maintenance or repair or when

the Contracting Officer considers its operation questionable. Requalify and recalibrate equipment in accordance with AWS D1.1/D1.1M, Clause 6, Part F.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Procedures and Methods

Use the pulse echo contact method with an A scan presentation for the ultrasonic inspection of welded joints, except that immersion techniques may be used for some applications when approved by the Contracting Officer. Use the procedures, methods, standards, and description of equipment specified herein for inspection of weldments. Include the following in the procedure description:

a. Couplant.

b. Search unit characteristics including angle, size, shape, nominal frequency, type designation.

c. Method and type of wave.

d. Equipment and accessories including manufacturer, model number, date of manufacture, last date of calibration, and the manufacturer's electrical, physical, and performance specifications.

e. Decibel (dB) compensation system for distance-amplitude correction.

2.1.2 Wave Types

The types of waves and the conditions under which they are used are specified below:

2.1.2.1 Shear Waves

Unless conditions prohibit, use shear waves. A longitudinal wave procedure may be used instead, if approved by the Contracting Officer. Use refracted waves between 40 degrees and 70 degrees except where different angles are indicated in approved procedures, such as for materials less than 1/2 inch thick, for materials with sound velocities greater than in steel, when the weldments are not readily accessible, or when existing backing rings or backing strips are not removed. For inspection of weldments containing backing rings or backing strips, adjust the instrument and select the refracted angles in a way to separate the weldment and the backing ring reflections. Establish the search unit angle and the resulting shear wave angle in the material to be inspected for each application and include this information in the procedure submitted for approval.

2.1.2.2 Longitudinal Waves

When conditions prohibit the use of shear waves, longitudinal waves may be used. Specifically develop the procedure to suit the application and attain the prior approval of the Contracting Officer.

2.1.3 Changes in Procedure

Should application of an approved procedure not provide for good resolution

or adequate ultrasonic penetration in the items to be inspected (see paragraph EQUIPMENT QUALIFICATIONS), make changes in procedure or equipment such as frequency, pulse repetition rate, angle of search unit, couplant, or oscilloscope. Demonstrate adequacy of the new procedure to the Contracting Officer. The Government reserves the right to require a change in test equipment during these tests if any of the following test system characteristics fall below the levels listed in paragraph EQUIPMENT QUALIFICATIONS: sensitivity, amplitude and distance linearity, signal-to-noise ratio, entry and back surface resolution and penetration.

2.1.4 Ultrasonic Equipment

Provide ultrasonic equipment conforming to the requirements listed in AWS D1.1/D1.1M Clause 6, Part F, with the following exceptions:

a. The ultrasonic test instruments must be able to generate, receive, and to present pulses in the frequency range from 1 to 10 megahertz (MHz).

b. Measure the horizontal linearity of the ultrasonic instrument in accordance with paragraph EQUIPMENT QUALIFICATIONS.

c. In addition to the resolution test specified in AWS D1.1/D1.1M, Clause 6, Part F, conduct both near- and far-surface resolution tests in accordance with the tests specified for these characteristics in the paragraph EQUIPMENT QUALIFICATIONS.

PART 3 EXECUTION

3.1 PREPARATION OF MATERIALS FOR INSPECTION

Surfaces must be free of the following:

3.1.1 Weld Spatter

Spattering or any roughness that interferes with free movement of the search unit or impairs transmission of the ultrasonic vibrations.

3.1.2 Irregularities

Those which could mask or be confused with defect indications.

3.1.3 Weld Backing Strips

Remove strips that are not to remain in place and eliminate all sharp edges and valleys by grinding or other mechanical means.

3.1.4 Dirt

Remove all loose scale, rust, paint, and dirt from the coupling surface.

3.2 EQUIPMENT CALIBRATION

Calibrate equipment in accordance with AWS D1.1/D1.1M, Clause 6, Part F.

3.3 INSPECTION PROCEDURE

Inspect welds in accordance with AWS D1.1/D1.1M, Clause 6, Part F.

3.4 ACCEPTANCE - REJECTION CRITERIA

EIn accordance with AWS D1.1/D1.1M, Clause 6, Part F.

3.4.1 Inspection Test Reports

Submit test reports containing the following information:

3.4.1.1 Identification and Location of Inspected Item

Name and place of the inspected item, the person performing the inspection, and the date of inspection.

3.4.1.2 Detail of Inspections

Details of methods, types of waves used, search units, frequencies, inspection equipment identification, and calibration data with enough information to permit duplication of the inspection at a later date.

3.4.1.3 Identification of Unacceptable Areas

Locations, dimensions, types, and area of unacceptable defects and discontinuities giving reflections over 50 percent of the reject/repair line. These may be noted on a sketch or marked-up drawing.

3.4.1.4 Record of Repair Areas

A record of repaired areas must be furnished as well as test results for the repaired areas.

3.4.2 Inspection of Repairs

All repairs undergo the same inspection procedure that originally revealed the discontinuities. Before acceptance, the welds must meet the standards required for the original weld.

-- End of Section --

SECTION 05 05 23.16

STRUCTURAL WELDING
05/14

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 360	(2016) Specification for Structural Steel Buildings

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189	(2016) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel (ANSI/ASNT CP-105-2006)

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(2012) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS D1.1/D1.1M	(2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel
AWS D1.4/D1.4M	(2011) Structural Welding Code - Reinforcing Steel
AWS D14.4/D14.4M	(2012) Specification for Welded Joints for Machinery and Equipment
AWS Z49.1	(2012) Safety in Welding and Cutting and Allied Processes

ASTM INTERNATIONAL (ASTM)

ASTM E165/E165M	(2012) Standard Practice for Liquid Penetrant Examination for General Industry
ASTM E709	(2015) Standard Guide for Magnetic Particle Examination

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Welding Quality Assurance Plan

SD-03 Product Data

Welding Procedure Qualifications
Welder, Welding Operator, and Tacker Qualification
Inspector Qualification
Previous Qualifications
Pre-Qualified Procedures
Welding Electrodes and Rods

SD-06 Test Reports

Nondestructive Testing

SD-07 Certificates

Certified Welding Procedure Specifications (WPS)
Certified Procedure Qualification Records (PQR)
Certified Welder Performance Qualifications (WPQ)
Certified Welding Inspector and Nondestructive Testing Personnel (NTP)

1.3 QUALITY ASSURANCE

Except for pre-qualified (in accordance with AWS D1.1/D1.1M) and previously qualified procedures, each Contractor performing welding must record in detail and qualify the welding procedure specification for any welding procedure followed in the fabrication of weldments. Conform welding procedure qualifications to AWS D1.1/D1.1M and to the specifications in this section. Submit for approval copies of the welding procedure specification and the results of the procedure qualification test records for each type of welding which requires procedure qualification and the welder, welding operator, or tacker qualification test records.. Approval of any procedure, however, does not relieve the Contractor of the sole responsibility for producing a finished structure meeting all the specified requirements. Submit this information on the forms in Annex M of AWS D1.1/D1.1M. Individually identify and clearly reference on the detail drawings and erection drawings all welding procedure specifications, or suitably key them to the contract drawings. In case of conflict between this specification and AWS D1.1/D1.1M, this specification governs.

1.3.1 General Requirements

Fabricate work in an AISC Certified Fabrication Plant, Category Std. Work must be erected by an AISC Certified Erector, Category ASCE.

a. For Structural Projects, provide documentation of the following:

 (1) Component Thickness 1/8 inch and greater: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D1.1/D1.1M.

 (2) Reinforcing Steel: Qualification documents (WPS, PWR, and WPQ) in accordance with AWS D1.4/D1.4M.

b. For other applications, provide documentation of the following:

(1) Submit two copies of the Certified Welding Procedure Specifications (WPS) and Certified Procedure Qualification Records (PQR) to the Contracting Officer for approval.

(2) Submit two copies of the Certified Welder Performance Qualifications (WPQ) to the Contracting Officer for approval within fifteen calendar days prior to any employee welding on the project material.

(3) Machinery: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D14.4/D14.4M.

1.3.2 Previous Qualifications

Welding procedures previously qualified by test may be accepted for this contract without re-qualification, upon receipt of the test results, if the following conditions are met:

a. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.

b. The qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.

c. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.3.3 Pre-qualified Procedures

Welding procedures which are considered pre-qualified as specified in AWS D1.1/D1.1M will be accepted without further qualification. Submit for approval a listing or an annotated drawing to indicate the joints not pre-qualified. Procedure qualification is mandatory for these joints.

1.3.4 Retests

If welding procedure fails to meet the requirements of AWS D1.1/D1.1M, revise and re-qualify the procedure specification, or at the Contractor's option, welding procedure may be retested in accordance with AWS D1.1/D1.1M. If the welding procedure is qualified through retesting, submit all test results, including those of test welds that failed to meet the requirements, with the welding procedure.

1.3.5 Welder, Welding Operator, and Tacker Qualification

Each welder, welding operator, and tacker assigned to work on this contract must be qualified in accordance with the applicable requirements of AWS D1.1/D1.1M and as specified in this section. Welders, welding operators, and tackers who make acceptable procedure qualification test welds will be considered qualified for the welding procedure used.

1.3.5.1 Previous Personnel Qualifications

At the discretion of the Contracting Officer, welders, welding operators, and tackers qualified by test within the previous 6 months may be accepted for this contract without re-qualification if all the following conditions are met:

a. Copies of the welding procedure specifications, the procedure qualification test records, and the welder, welding operator, and tacker qualification test records are submitted and approved in accordance with the specified requirements for detail drawings.

b. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.

c. The previously qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.

d. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.3.5.2 Certificates

Before assigning any welder, welding operator, or tacker to work under this contract, submit the names of the welders, welding operators, and tackers to be employed, and certification that each individual is qualified as specified. State in the certification the type of welding and positions for which the welder, welding operator, or tacker is qualified, the code and procedure under which the individual is qualified, the date qualified, and the name of the firm and person certifying the qualification tests. Keep the certification current, on file, and furnish 3 copies.

1.3.5.3 Renewal of Qualification

Re-qualification of a welder or welding operator is required under any of the following conditions:

a. It has been more than 6 months since the welder or welding operator has used the specific welding process for which he is qualified.

b. There is specific reason to question the welder or welding operator's ability to make welds that meet the requirements of these specifications.

c. The welder or welding operator was qualified by an employer other than those firms performing work under this contract, and a qualification test has not been taken within the past 12 months. Submit as evidence of conformance all records showing periods of employment, name of employer where welder, or welding operator, was last employed, and the process for which qualified.

d. A tacker who passes the qualification test is considered eligible to perform tack welding indefinitely in the positions and with the processes for which he/she is qualified, unless there is some specific reason to question the tacker's ability. In such a case, the tacker is required to pass the prescribed tack welding test.

1.3.6 Inspector Qualification

Submit inspector qualificationsand certifications that are in accordance with AWS D1.1/D1.1M. Qualify all nondestructive testing personnel in accordance with the requirements of ANSI/ASNT CP-189 for Levels I or II in the applicable nondestructive testing method. The inspector may be

supported by assistant welding inspectors who are not qualified to AWS D1.1/D1.1M, and assistant inspectors may perform specific inspection functions under the supervision of the qualified inspector, as allowed by AWS D1.1/D1.1M.All inspectors must have direct supervision of a Level II Inspector.

Submit two copies of the Certified Welding Inspector and Nondestructive Testing Personnel (NTP)to the Contracting Office for approval.

1.3.7 Symbols and Safety

Use symbols in accordance with AWS A2.4, unless otherwise indicated. Follow safe welding practices and safety precautions during welding in conformance with AWS Z49.1.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Conform the design of welded connections to AISC 360, unless otherwise indicated or specified. Material with welds will not be accepted unless the welding is specified or indicated on the drawings or otherwise approved. Perform welding as specified in this section, except where additional requirements are shown on the drawings or are specified in other sections. Do not commence welding until welding procedures, inspectors, nondestructive testing personnel, welders, welding operators, and tackers have been qualified and the submittals approved by the Contracting Officer. Perform all testing at or near the work site. Maintain records of the test results obtained in welding procedure, welder, welding operator, and tacker performance qualifications.

2.1.1 Pre-erection Conference

Hold a pre-erection conference prior to the start of the field welding, to bring all affected parties together and to gain a naturally clear understanding of the project and the Welding Procedure Specifications (WPS) (submitted for all welding, including welding done using pre-qualified procedures). Mandatory attendance is required by all Contractor's welding production and inspection personnel and appropriate Government personnel. Include as items for discussion: responsibilities of various parties; welding procedures and processes to be followed; welding sequence (both within a joint and joint sequence within the building); inspection requirements and procedures, both visual and nondestructive testing; welding schedule; and other items deemed necessary by the attendees.

2.2 WELDING EQUIPMENT AND MATERIALS

Provide all welding equipment, welding electrodes and rods, welding wire, and fluxes capable of producing satisfactory welds when used by a qualified welder or welding operator performing qualified welding procedures. Use 60XX welding electrodes. Provide welding equipment and materials that comply with the applicable requirements of AWS D1.1/D1.1M. Submit product data on welding electrodes and rods.

PART 3 EXECUTION

3.1 WELDING OPERATIONS

3.1.1 Requirements

Conform workmanship and techniques for welded construction to the requirements of AWS D1.1/D1.1M and AISC 360. When AWS D1.1/D1.1M and the AISC 360 specification conflict, the requirements of AWS D1.1/D1.1M govern.

3.1.2 Identification

Identify all welds in one of the following ways:

a. Submit written records to indicate the location of welds made by each welder, welding operator, or tacker.

b. Identify all work performed by each welder, welding operator, or tacker with an assigned number, letter, or symbol to identify welds made by that individual. The Contracting Officer may require welders, welding operators, and tackers to apply their symbol next to the weld by means of rubber stamp, felt-tipped marker with waterproof ink, or other methods that do not cause an indentation in the metal. Place the identification mark for seam welds adjacent to the weld at 3 foot intervals. Identification with die stamps or electric etchers is not allowed.

3.2 QUALITY CONTROL

Perform testing using an approved inspection or testing laboratory or technical consultant; or if approved, the Contractor's inspection and testing personnel may be used instead of the commercial inspection or testing laboratory or technical consultant. Perform visual and ultrasonic inspections to determine conformance with paragraph STANDARDS OF ACCEPTANCE. Conform procedures and techniques for inspection with applicable requirements of AWS D1.1/D1.1M, ASTM E165/E165M, and ASTM E709. Submit a Welding Quality Assurance Plan and records of tests and inspections.The Certified Welding Inspector shall perform visual inspection on 100 percent of all welds.

3.3 STANDARDS OF ACCEPTANCE

Conform dimensional tolerances for welded construction, details of welds, and quality of welds with the applicable requirements of AWS D1.1/D1.1M and the contract drawings. Perform nondestructive testing by visual inspection and ultrasonic methods. The minimum extent of nondestructive testing must be random 40 percent of welds or joints, as indicated on the drawings. Submit all records of nondestructive testing.

3.3.1 Nondestructive Testing

The welding is subject to inspection and tests in the mill, shop, and field. Inspection and tests in the mill or shop do not relieve the Contractor of the responsibility to furnish weldments of satisfactory quality. When materials or workmanship do not conform to the specification requirements, the Government reserves the right to reject material or workmanship or both at any time before final acceptance of the structure containing the weldment. Any indication of a defect is regarded as a defect, unless re-evaluation by nondestructive methods or by surface

conditioning shows that no unacceptable defect is present. Submit all records of nondestructive testing in accordance with paragraph STANDARDS OF ACCEPTANCE.

3.3.2 Destructive Tests

Make all repairs when metallographic specimens are removed from any part of a structure. Employ only qualified welders or welding operators, and use the proper joints and welding procedures, including peening or heat treatment if required, to develop the full strength of the members and joints cut and to relieve residual stress.

3.4 GOVERNMENT INSPECTION AND TESTING

In addition to the inspection and tests performed by the Contractor for quality control, the Government will perform inspection and testing for acceptance to the extent determined by the Contracting Officer. The costs of such inspection and testing will be borne by the Contractor if unsatisfactory welds are discovered, or by the Government if the welds are satisfactory. The work may be performed by the Government's own forces or under a separate contract for inspection and testing. The Government reserves the right to perform supplemental nondestructive and destructive tests to determine compliance with paragraph STANDARDS OF ACCEPTANCE.

3.5 CORRECTIONS AND REPAIRS

If inspection or testing indicates defects in the weld joints, repair defective welds using a qualified welder or welding operator as applicable. Conduct corrections in accordance with the requirements of AWS D1.1/D1.1M and the specifications. Repair all defects in accordance with the approved procedures. Repair defects discovered between passes before additional weld material is deposited. Wherever a defect is removed and repair by welding is not required, blend the affected area into the surrounding surface to eliminate sharp notches, crevices, or corners. After a defect is thought to have been removed, and before re-welding, examine the area by suitable methods to ensure that the defect has been eliminated. Repaired welds must meet the inspection requirements for the original welds.

-- End of Section --

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SECTION 05 12 00

STRUCTURAL STEEL
05/14

PART 1 GENERAL

1.1 SCOPE

This specification covers the gate structures, gate support frames, and all connections to these structures.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 303	(2016) Code of Standard Practice for Steel Buildings and Bridges
AISC 325	(2017) Steel Construction Manual
AISC 326	(2009) Detailing for Steel Construction
AISC 341	(2016) Seismic Provisions for Structural Steel Buildings
AISC 360	(2016) Specification for Structural Steel Buildings

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(2012) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS D1.1/D1.1M	(2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel
AWS D1.8/D1.8M	(2009) Structural Welding Code—Seismic Supplement

ASME INTERNATIONAL (ASME)

ASME B46.1	(2009) Surface Texture, Surface Roughness, Waviness and Lay

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A307	(2014; E 2017) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

ASTM A325	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A36/A36M	(2014) Standard Specification for Carbon Structural Steel
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A588/A588M	(2015) Standard Specification for High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point, with Atmospheric Corrosion Resistance
ASTM A6/A6M	(2017a) Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A780/A780M	(2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM C1107/C1107M	(2017) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C827/C827M	(2016) Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
ASTM F1554	(2017; E 2018) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
ASTM F2329	(2013) Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
ASTM F3125/F3125M	(2015a) Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions
ASTM F436	(2011) Hardened Steel Washers
ASTM F436/F436M	(2016) Standard Specification for Hardened Steel Washers Inch and Metric Dimensions
ASTM F844	(2007a; R 2013) Washers, Steel, Plain (Flat), Unhardened for General Use

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01	(2013; with Change 3) Structural Engineering

UFC 3-310-04 (2013; with Change 1) Seismic Design for Buildings

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Erection Drawings

SD-02 Shop Drawings

Fabrication Drawings Including Description of Connections

SD-03 Product Data

Welding Electrodes and Rods

Non-Shrink Grout

Tension Control Bolts

SD-06 Test Reports

Bolts, Nuts, and Washers

Weld Inspection Reports

Bolt Testing Reports

SD-07 Certificates

Steel

Bolts, Nuts, and Washers

Galvanizing

AISC Fabrication Plant Quality Certification

AISC Erector Quality Certification

Welding Procedures and Qualifications

Welding Electrodes and Rods

1.4 AISC QUALITY CERTIFICATION

Work must be fabricated in an AISC Certified Fabrication Plant, Category HYD. Submit AISC fabrication plant quality certification.

Work must be erected by an AISC Certified Erector, Category CSE. Submit AISC erector quality certification.

1.5 QUALITY ASSURANCE

1.5.1 Preconstruction Submittals

1.5.1.1 Erection Drawings

Submit for record purposes. Indicate the sequence of erection, temporary shoring and bracing. The erection drawings must conform to AISC 303. Erection drawings must be reviewed, stamped and sealed by a registered professional engineer.

1.5.2 Fabrication Drawing Requirements

Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with AISC 326 and AISC 325. Fabrication drawings must not be reproductions of contract drawings. Sign and seal fabrication drawings by a registered professional engineer. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use AWS A2.4 standard welding symbols. Shoring and temporary bracing must be designed and sealed by a registered professional engineer and submitted for record purposes. Any deviations from the details shown on the contract drawings must be clearly highlighted on the fabrication drawings. Explain the reasons for any deviations from the contract drawings.

1.5.3 Certifications

1.5.3.1 Welding Procedures and Qualifications

Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. If the qualification date of the welding operator is more than one-year old, the welding operator's qualification certificate must be accompanied by a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months.

Conform to all requirements specified in AWS D1.1/D1.1M and AWS D1.8/D1.8M.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide the structural steel system, including galvanizing, complete and ready for use. Structural steel systems including design, materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing must be provided in accordance with AISC 360, AISC 341, UFC 3-301-01 and UFC 3-310-04 except as modified in this contract.

2.2 STEEL

2.2.1 Structural Steel

Wide flange and WT shapes, Angles, Channels and Plates, ASTM A588/A588M Grade 50.

2.3 BOLTS, NUTS, AND WASHERS

Submit the certified manufacturer's mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied fasteners. All carbon steel fasteners shall be galvanized.

2.3.1 High-Strength Bolts

2.3.1.1 Bolts

ASTM F3125/F3125M, Type 3.High strength bolts and nuts must be shipped together in the same shipping container.

2.3.1.2 Nuts

ASTM A563, Grade and Style as specified in the applicable ASTM bolt standard.

2.3.1.3 Washers

ASTM F436, plain carbon steel.

2.3.2 Foundation Anchorage

2.3.2.1 Anchor Rods

ASTM F1554 Gr 105.

2.3.2.2 Anchor Nuts

ASTM A563, Grade A, hex style.

2.3.2.3 Anchor Washers

ASTM F844.

2.3.2.4 Anchor Plate Washers

ASTM A36/A36M.

2.4 STRUCTURAL STEEL ACCESSORIES

2.4.1 Welding Electrodes and Rods

AWS D1.1/D1.1M.

2.4.2 Non-Shrink Grout

ASTM C1107/C1107M, with no ASTM C827/C827M shrinkage.

2.5 GALVANIZING

ASTM F2329 for threaded parts or ASTM A123/A123M for structural steel members, as applicable, unless specified otherwise galvanize after fabrication where practicable.

2.6 FABRICATION

Fabrication must be in accordance with the applicable provisions of AISC 325. Fabrication and assembly must be done in the shop to the greatest extent possible. Punch, subpunch and ream, or drill bolt and pin holes perpendicular to the surface of the member.

Compression joints depending on contact bearing must have a surface roughness not in excess of 500 micro inch as determined by ASME B46.1, and ends must be square within the tolerances for milled ends specified in ASTM A6/A6M.

Shop splices of members between field splices will be permitted only where indicated on the Contract Drawings. Splices not indicated require the approval of the Contracting Officer.

2.6.1 Markings

Prior to erection, members must be identified by a painted erection mark. Connecting parts assembled in the shop for reaming holes in field connections must be match marked with scratch and notch marks. Do not locate erection markings on areas to be welded. Do not locate match markings in areas that will decrease member strength or cause stress concentrations.

2.6.2 Surface Finishes

ASME B46.1 maximum surface roughness of 125 for pin, pinholes, and sliding bearings, unless indicated otherwise.

2.7 DRAINAGE HOLES

Adequate drainage holes must be drilled to eliminate water traps. Hole diameter must be 1/2 inch and location must be indicated on the detail drawings. Hole size and location must not affect the structural integrity.

PART 3 EXECUTION

3.1 ERECTION

Erection of structural steel, must be in accordance with the applicable provisions of AISC 325.

3.1.1 STORAGE

Material must be stored out of contact with the ground in such manner and location as will minimize deterioration.

3.2 CONNECTIONS

Except as modified in this section, connections not detailed must be designed in accordance with AISC 360. Build connections into existing work. Do not tighten anchor bolts set in concrete with impact torque wrenches. Holes must not be cut or enlarged by burning. Bolts, nuts, and washers must be clean of dirt and rust, and lubricated immediately prior to installation.

3.2.1 Common Grade Bolts

Tighten ASTM A307 bolts to a "snug tight" fit. "Snug tight" is the tightness that exists when plies in a joint are in firm contact.Torque applied to meet the tightening requirements shall be 80% of a properly lubricated and aligned fastener assembly.

3.2.2 High-Strength Bolts

Provide ASTM F436/F436M washers in all ASTM A325 bolted connections. Bolts must be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, bolts must then be fully tensioned, progressing from the most rigid part of a connection to the free edges.

3.2.3 Tension Control Bolts

Bolts must be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, bolts must then be fully tensioned, progressing from the most rigid part of a connection to the free edges.

3.3 GAS CUTTING

Use of gas-cutting torch in the field for correcting fabrication errors will not be permitted on any major member in the structural framing. Use of a gas cutting torch will be permitted on minor members not under stress only after approval has been obtained from the Contracting Officer.

3.4 WELDING

Welding must be in accordance with AWS D1.1/D1.1M. Provide AWS D1.1/D1.1M qualified welders, welding operators, and tackers.

Develop and submit the Welding Procedure Specifications (WPS) for all welding, including welding done using prequalified procedures. Prequalified procedures may be submitted for information only; however, procedures that are not prequalified must be submitted for approval.

3.4.1 Removal of Temporary Welds, Run-Off Plates, and Backing Strips

Remove backing strips from bottom flange of moment connections, backgouge the root pass to sound weld metal and reinforce with a 5/16 inch fillet weld minimum.

3.5 GALVANIZING REPAIR

Repair damage to galvanized coatings using ASTM A780/A780M zinc rich paint for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces to which repair paint has been applied.

3.6 FIELD QUALITY CONTROL

Perform field tests, and provide labor, equipment, and incidentals required for testing. The Contracting Officer must be notified in writing of defective welds, bolts, nuts, and washers within 7 working days of the date of the inspection.

3.6.1 Welds

3.6.1.1 Visual Inspection

AWS D1.1/D1.1M. Furnish the services of AWS-certified welding inspectors for fabrication and erection inspection and testing and verification inspections.Certified Welding Inspector must perform visual inspection on 100 percent of all welds. Document this inspection in the Visual Weld Inspection Log. Submit certificates indicating that certified welding inspectors meet the requirements of AWS QC1.

Inspection by the Government will include proper preparation, size, gaging location, and acceptability of welds; identification marking; operation and current characteristics of welding sets in use.

Inspect proper preparation, size, gaging location, and acceptability of welds; identification marking; operation and current characteristics of welding sets in use.

3.6.1.2 Nondestructive Testing

Nondestructive testing must be in accordance with AWS D1.1/D1.1M.All personnel performing nondestructive testing in accordance with with this specification must be certified in accordance with ANSI/ASNT CP-189 in the method of testing being performed. Submit certificates showing compliance with ANSI/ASNT CP-189 for all NDT technicians. Test locations must be selected by the Contracting Officer. If more than 20 percent of welds made by a welder contain defects identified by testing, then all welds made by that welder must be tested by ultrasonic testing, as approved by the Contracting Officer. When all welds made by an individual welder are required to be tested, magnetic particle testing must be used only in areas inaccessible to ultrasonic testing. Retest defective areas after repair. Submit weld inspection reports.

Testing frequency: Provide the following types and number of tests:

Test Type	Number of Tests
Ultrasonic	10 percent of all splices
Magnetic Particle	100 percent of all full penetration welds, 50 percent of all fillet welds
Dye Penetrant	10 percent of all fillet welds

3.6.2 High-Strength Bolts

3.6.2.1 Testing Bolt, Nut, and Washer Assemblies

Test a minimum of 3 bolt, nut, and washer assemblies from each mill certificate batch in a tension measuring device at the job site prior to the beginning of bolting start-up.A representative of the manufacturer or supplier must be present to ensure that the fasteners are properly used, and to demonstrate that the fastener assemblies supplied satisfy the specified requirements when high strength bolts are tested in accordance with this Specification. Demonstrate that the bolts and nuts, when used together, can develop tension not less than the provisions specified in AISC 360, depending on bolt size and grade. The bolt tension must be

developed by tightening the nut. Submit bolt testing reports.

3.6.2.2 Inspection

Inspection procedures must be in accordance with AISC 360. Confirm and report to the Contracting Officer that the materials meet the project specification and that they are properly stored. Confirm that the faying surfaces have been properly prepared before the connections are assembled. Observe the specified job site testing and calibration, and confirm that the procedure to be used provides the required tension. Monitor the work to ensure the testing procedures are routinely followed on joints that are specified to be fully tensioned.

3.6.2.3 Testing

The Government has the option to perform nondestructive tests on 5 percent of the installed bolts to verify compliance with pre-load bolt tension requirements. Provide the required access for the Government to perform the tests. The nondestructive testing will be done in-place using an ultrasonic measuring device or any other device capable of determining in-place pre-load bolt tension. The test locations must be selected by the Contracting Officer. If more than 10 percent of the bolts tested contain defects identified by testing, then all bolts used from the batch from which the tested bolts were taken, must be tested at the Contractor's expense. Retest new bolts after installation at the Contractor's expense.

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SECTION 05 50 13

MISCELLANEOUS METAL FABRICATIONS
05/17

PART 1 GENERAL

1.1 SCOPE

This Specification covers miscellaneous metal structures that are not covered under Section 05 12 00, such as bollards, operator's platforms, ladders, and extension fence, etc.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 318	(2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 303	(2016) Code of Standard Practice for Steel Buildings and Bridges

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B18.2.1	(2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)
ASME B18.21.1	(2009; R 2016) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)
ASME B18.22M	(1981; R 2017) Metric Plain Washers

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A47/A47M	(1999; R 2014) Standard Specification for Ferritic Malleable Iron Castings
ASTM A48/A48M	(2003; R 2012) Standard Specification for Gray Iron Castings

ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A780/A780M	(2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM D1187/D1187M	(1997; E 2011; R 2011) Asphalt-Base Emulsions for Use as Protective Coatings for Metal
ASTM E488/E488M	(2015) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
ASTM F1554	(2017; E 2018) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

MASTER PAINTERS INSTITUTE (MPI)

MPI 79	(2012) Primer, Alkyd, Anti-Corrosive for Metal

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531	(2017) Metal Bar Grating Manual

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Floor Gratings, Installation Drawings

Bollards/Pipe Guards

SD-03 Product Data

Floor Gratings

1.4 QUALIFICATION OF WELDERS

Qualify welders in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work.

1.5 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store

items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

1.6 MISCELLANEOUS REQUIREMENTS

1.6.1 Fabrication Drawings

Submit fabrication drawings showing layout(s), connections to structural system, and anchoring details as specified in AISC 303.

1.6.2 Installation Drawings

Submit templates, erection, and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation in relation to the building construction.

PART 2 PRODUCTS

2.1 MATERIALS

Provide exposed fastenings of compatible materials (avoid contact of dissimilar metals). Coordinate color and finish with the material to which fastenings are applied.

2.1.1 Steel Pipe

Provide in accordance with ASTM A53/A53M, Type E or S, Grade B.

2.1.2 Fittings for Steel Pipe

Provide standard malleable iron fittings in accordance with ASTM A47/A47M.

2.1.3 Gratings

a. Provide gray cast iron in accordance with ASTM A48/A48M, Class 40.

b. Provide metal bar type grating in accordance with NAAMM MBG 531.

2.1.4 Anchor Bolts

Provide in accordance with ASTM F1554 . Where exposed, provide anchor bolts of the same material, color, and finish as the metal to which they are applied. Provide ASTM F1554 anchor bolts for miscellaneous metal fabrications.

2.1.4.1 Expansion Anchors

Provide 5/8 in. diameter expansion anchors. Minimum concrete embedment of 4 in. Design values listed are as tested in accordance with ASTM E488/E488M.

a. Provide minimum allowable pullout value of 4000 lb. Calculate pullout capacity according to ACI 318.

b. Provide minimum allowable shear value of 2000 lb. Calculate shear capacity according to ACI 318.

2.1.4.2 Lag Screws and Bolts

Provide in accordance with ASME B18.2.1, type and grade best suited for the purpose.

2.1.4.3 Bolts and Nuts

Provide in accordance with ASTM F1554.

2.1.4.4 Washers

Provide plain washers in accordance with ASME B18.22M, ASME B18.21.1, and ASTM F1554.

2.2 FABRICATION FINISHES

2.2.1 Galvanizing

Hot-dip galvanize all carbon steel items to be zinc-coated, after fabrication where practicable. Provide galvanizing in accordance with ASTM A123/A123M.

2.2.2 Galvanize

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

2.2.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint in accordance with ASTM A780/A780M or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat, with a torch, surfaces to which stick or paste material will be applied. Heat to a temperature sufficient to melt the metals in the stick or paste. Spread molten material uniformly over surfaces to be coated and wipe off excess material.

2.2.4 Shop Cleaning and Painting

2.2.4.1 Surface Preparation

Blast clean surfaces in accordance with SSPC SP 6/NACE No.3. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean. Steel to be embedded in concrete must be free of dirt and grease prior to embed. Do not paint or galvanize bearing surfaces, including contact surfaces within slip critical joints. Shop coat these surfaces with rust prevention.

2.2.4.2 Pretreatment, Priming and Painting

Apply pre-treatment, primer, and paint in accordance with manufacturer's printed instructions. On surfaces concealed in the finished construction or not accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of 1.0 mil. Tint additional prime coat with a small amount of tinting pigment.

2.3 FLOOR GRATINGS

Design steel grating in accordance with NAAMM MBG 531 for bar type gratings, or in accordance with manufacturer's charts for plank grating. Galvanize steel floor gratings.

a. Design floor gratings to support a stress live load of 100 pounds per square foot for the spans indicated, with maximum deflection of L/240.

b. In accordance with NAAMM MBG 531 band edges of grating with bars of the same size as the bearing bars. Weld banding in accordance with the manufacturer's standard for trim. Design tops of bearing bars, cross or intermediate bars to be in the same plane and to match grating finish.

c. In accordance with NAAMM MBG 531, band ends of gratings with bars of the same or greater thickness than the metal used for grating. Weld banding bars to bearing bars or channels at least every fourth bar or channel and in every corner. Tack weld intervening bars or channels. Band diagonal or round cuts by welding bars of the same or greater thickness as the grating and in accordance with the manufacturer's standard for trim.

d. Anchor gratings to structural members with bolts, toggle bolts, or expansion shields and bolts.

e. Provide slip resistant surface finishes.

2.4 BOLLARDS/PIPE GUARDS

Provide galvanized extra strong weight steel pipe in accordance with ASTM A53/A53M. Anchor posts as indicated and fill solidly with concrete with minimum compressive strength of 3000 psi.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and harmonize with the material to which fastenings are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners shall be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Form joints exposed to the weather shall be formed to exclude water.

3.2 WORKMANSHIP

Provide miscellaneous metalwork that is true and accurate in shape, size, and profile. Make angles and lines continuous and straight. Make curves consistent, smooth and unfaceted. Provide continuous welding along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections. Unless otherwise indicated and approved, provide a smooth finish on exposed surfaces. Provide countersunk rivets where exposed. Provide coped and mitered corner joints aligned flush and without gaps.

3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage as necessary, whether indicated or not, for fastening miscellaneous metal items securely in place. Include slotted inserts, expansion shields, powder-driven fasteners, toggle bolts through bolts for masonry, headed shear studs, machine and carriage bolts for steel, through bolts, lag bolts, and screws for wood. Do not use wood plugs. Provide non-ferrous attachments for non-ferrous metal. Provide exposed fastenings of compatible materials that generally match in color and finish the surfaces to which they are applied. Conceal fastenings where practicable. Provide all fasteners flush with the surfaces they fasten, unless indicated otherwise.

3.4 BUILT-IN WORK

Where necessary and not otherwise indicated, form built-in metal work for anchorage with concrete or masonry. Provide built-in metal work in ample time for securing in place as the work progresses.

3.5 WELDING

Perform welding, welding inspection, and corrective welding in accordance with AWS D1.1/D1.1M. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

3.6 DISSIMILAR METALS

Where dissimilar metals are in contact, protect surfaces with a coating in accordance with MPI 79 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect in accordance with ASTM D1187/D1187M, asphalt-base emulsion. Clean surfaces with metal shavings from installation at the end of each work day.

3.7 PREPARATION

3.7.1 Material Coatings and Surfaces

Remove rust preventive coating just prior to field erection, using a remover approved by the metal manufacturer. Surfaces, when assembled, must be free of rust, grease, dirt and other foreign matter.

3.7.2 Environmental Conditions

Do not clean or paint surfaces when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than minus 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

3.8 INSTALLATION OF BOLLARDS/PIPE GUARDS

Set bollards/pipe guards vertically. Fill hollow cores with concrete having a compressive strength of 3000 psi.Concrete filled bollards shall be crowned/domed with concrete to facilitate precipitation runoff.

Contractor to ensure that bollards meet the requirements of TxDOT Special Specification 4042, Bollards (Attachment); including retro-reflectivity

requirements as specified by the Texas MUTCD and the ATSSA (American Traffic Safety Services Administration) Brochure on Retro-Reflectivity.

-- End of Section --

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SECTION 07 92 00

JOINT SEALANTS
08/16

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C1193	(2013) Standard Guide for Use of Joint Sealants
ASTM C1521	(2013) Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	SCS Global Services (SCS)Indoor Advantage

UNDERWRITERS LABORATORIES (UL)

UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Sealants.

Primers.

Bond Breakers.

SD-06 Test Reports

Field Adhesion.

1.3 PRODUCT DATA

Include storage requirements, shelf life, curing time, instructions for mixing and application, and accessories. Provide manufacturer's Safety Data Sheets (SDS) for each solvent, primer and sealant material proposed.

1.4 INDOOR AIR QUALITY CERTIFICATIONS

1.4.1 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide validation by other third-party program that products meet the requirements of this paragraph. Provide current product certification documentation from certification body.

1.5 ENVIRONMENTAL CONDITIONS

Apply sealant when the ambient temperature is between 40 and 90 degrees F.

1.6 DELIVERY AND STORAGE

Deliver materials to the jobsite in unopened manufacturers' sealed shipping containers, with brand name, date of manufacture, and material designation clearly marked thereon. Label elastomeric sealant containers to identify type, class, grade, and use. Handle and store materials in accordance with manufacturer's printed instructions. Prevent exposure to foreign materials or subjection to sustained temperatures exceeding 90 degrees F or lower than 0 degrees F. Keep materials and containers closed and separated from absorptive materials such as wood and insulation.

1.7 QUALITY ASSURANCE

1.7.1 Compatibility with Substrate

Verify that each sealant is compatible for use with each joint substrate in accordance with sealant manufacturer's printed recommendations for each application.

1.7.2 Joint Tolerance

Provide joint tolerances in accordance with manufacturer's printed instructions.

1.7.3 Adhesion

Provide in accordance with ASTM C1193 or ASTM C1521.

PART 2 PRODUCTS

2.1 SEALANTS

Provide sealant products that have been tested, found suitable, and documented as such by the manufacturer for the particular substrates to which they will be applied.

2.2 PRIMERS

Non-staining, quick drying type and consistency as recommended by the sealant manufacturer for the particular application. Provide primers for interior applications that meet the indoor air quality requirements of the paragraph SEALANTS above.

2.3 BOND BREAKERS

Type and consistency as recommended by the sealant manufacturer to prevent adhesion of the sealant to the backing or to the bottom of the joint. Provide bond breakers for interior applications that meet the indoor air quality requirements of the paragraph SEALANTS above.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

Perform a field adhesion test in accordance with manufacturer's instructions and ASTM C1193, Method A or ASTM C1521, Method A, Tail Procedure. Remove sealants that fail adhesion testing; clean substrates, reapply sealants, and re-test. Test sealants adjacent to failed sealants. Submit field adhesion test report indicating tests, locations, dates, results, and remedial actions taken.

3.2 SURFACE PREPARATION

Prepare surfaces according to manufacturer's printed installation instructions. Clean surfaces from dirt, frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would destroy or impair adhesion. Remove oil and grease with solvent; thoroughly remove solvents prior to sealant installation. Wipe surfaces dry with clean cloths. When resealing an existing joint, remove existing caulk or sealant prior to applying new sealant. For surface types not listed below, provide in accordance with sealant manufacturer's printed instructions for each specific surface.

3.2.1 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, remove materials by sandblasting or wire brushing. Remove laitance, efflorescence and loose mortar from the joint cavity. Remove resulting debris prior to sealant installation.

3.3 SEALANT PREPARATION

Do not add liquids, solvents, or powders to sealants. Mix multicomponent elastomeric sealants in accordance with manufacturer's printed instructions.

3.4 APPLICATION

3.4.1 Joint Width-To-Depth Ratios

Acceptable Ratios:

JOINT WIDTH	JOINT DEPTH	
	Minimum	Maximum
For concrete:		
1/4 inch (minimum)	1/4 inch	1/4 inch

JOINT WIDTH	JOINT DEPTH	
	Minimum	Maximum
over 1/4 inch to 1/2 inch	1/4 inch	Equal to width
over 1/2 inch to 1 inch	1/2 inch	5/8 inch
Over 1 inch	prohibited	

Unacceptable Ratios: Where joints of acceptable width-to-depth ratios have not been provided, clean out joints to acceptable depths and grind or cut to acceptable widths without damage to the adjoining work. Grinding is prohibited at metal surfaces.

3.4.2 Unacceptable Sealant Use

Do not install sealants in lieu of other required building enclosure weatherproofing components such as flashing, drainage components, and joint closure accessories, or to close gaps between walls, floors, roofs, windows, and doors, that exceed acceptable installation tolerances. Remove sealants that have been used in an unacceptable manner and correct building enclosure deficiencies to comply with contract documents requirements.

3.4.3 Primer

Clean out loose particles from joints immediately prior to application of. Apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's printed instructions. Do not apply primer to exposed finished surfaces.

3.4.4 Bond Breaker

Provide bond breakers to surfaces not intended to bond in accordance with, sealant manufacturer's printed instructions for each type of surface and sealant combination specified.

3.4.5 Sealants

Provide sealants compatible with the material(s) to which they are applied. Do not use a sealant that has exceeded its shelf life or has jelled and cannot be discharged in a continuous flow from the sealant gun. Apply sealants in accordance with the manufacturer's printed instructions with a gun having a nozzle that fits the joint width. Work sealant into joints so as to fill the joints solidly without air pockets. Tool sealant after application to ensure adhesion. Apply sealant uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints, apply additional sealant, and tool smooth as specified. Apply sealer over sealants in accordance with the sealant manufacturer's printed instructions.

3.5 PROTECTION AND CLEANING

3.5.1 Protection

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled and no residual tape marks remain.

3.5.2 Final Cleaning

Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

a. Masonry and Other Porous Surfaces: Immediately remove fresh sealant that has been smeared on adjacent masonry, rub clean with a solvent, and remove solvent residue, in accordance with sealant manufacturer's printed instructions. Allow excess sealant to cure for 24 hour then remove by wire brushing or sanding. Remove resulting debris.

-- End of Section --

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SECTION 09 97 13.00 40

STEEL COATINGS
11/14

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC AB 1	(2015; E 2017) Mineral and Slag Abrasives
SSPC Painting Manual	(2002) Good Painting Practice, Steel Structures Painting Manual, Volume 1
SSPC SP 1	(2015) Solvent Cleaning
SSPC SP 10/NACE No. 2	(2007) Near-White Blast Cleaning
SSPC SP 3	(1982; E 2004) Power Tool Cleaning

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1000	Air Contaminants
29 CFR 1910.134	Respiratory Protection

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists.

A Safety Plan

SD-03 Product Data

Abrasive Blasting Material

Sealant Compound

Inorganic Zinc

Inhibitive Polyamide Epoxy

Aliphatic Polyurethane

SD-04 Samples

Manufacturer's Standard Color Charts

Inspection Forms

SD-05 Design Data

Mix Designs

Inorganic Zinc

Inhibitive Polyamide Epoxy

Aliphatic Polyurethane

SD-06 Test Reports

Inspection Reports

Test Reports

SD-07 Certificates

Abrasive Blasting Material

Sealant Compound

Inorganic Zinc Coating

Inhibitive Polyamide Epoxy

Aliphatic Polyurethane

SD-08 Manufacturer's Instructions

Protective Coatings

SD-11 Closeout Submittals

Warranty

1.3 QUALITY CONTROL

Submit a safety plan for protective coating systems in accordance with OSHA regulations.

Submit manufacturer's standard color charts showing manufacturer's standard finish colors.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials in their original, unopened containers bearing the manufacturer's name, shelf-life, product identification, and batch number.

Store coatings, thinners, and cleaners in tightly closed containers in a covered, well-ventilated area; protected from exposure to extreme cold or heat, sparks, flame, direct sunlight, or rainfall. Follow manufacturer's instructions for storage limitations.

1.5 WARRANTY

Provide a Manufactures' warranty for each coating used.

PART 2 PRODUCTS

Submit a material, equipment, and fixture lists for manufacturer's style or catalog numbers, specification and drawing reference numbers and warranty information for the protective coatings systems fabrication site.

2.1 MATERIALS

2.1.1 Abrasive Blasting Material

Ensure abrasive blasting materials conforms to SSPC Painting Manual, Chapter 2.4, and SSPC AB 1.

2.1.2 Sealant Compound

Sealant is a self-curing, single component, polysulfide-rubber type conforming to ASTM C920. Provide a sealant gray in color and capable of being applied into the joint with a caulking gun.

2.1.3 Protective Coatings

Submit mix designs for each type of protective coating including a complete list of ingredients and admixtures. Submit applicable test reports verifying that the mix has been successfully tested and meets design requirements.

2.1.3.1 Coating Systems

The following two coating systems definitions are to be specified for use on the surfaces listed in the Coating Schedule, of this section, and as directed.

Coating System No. 1 consists of inorganic zinc only, no top coat unless specified. Select inorganic zinc from the following listing. Ensure coatings, thinners, and cleaners are the product of one manufacturer.

Coating System No. 2 consists of an inorganic zinc first coat, inhibitive polyamide epoxy intermediate coat, and aliphatic polyurethane finish coat. Select coatings from the following listing. Ensure all coatings, thinners, and cleaners are the product of the same manufacturer. Ensure each successive coating is a contrasting color to provide a visual assurance of complete coverage.

COATING SYSTEMS			
INORGANIC ZINC	INHIBITIVE POLYAMIDE EPOXY	ALIPHATIC POLYURETHANE	MANUFACTURER
Dimetcote 9	Amercoat 370	Amercoat 450HS	PPG One PPG Place Pittsburgh, PA 15272 412/434-3131
CarboZinc 11	Carboguard 893	Carbothane 134HG	Carboline Company 350 Hanley Industrial Court St. Louis, MO 63144 800/848-4645 Ext. 2557
Catha-Coat 304V	Devran 201H	Devthane 359	ICI-DEVOE 925 Euclid Ave. Cleveland, OH 44115 216/344-8798
Ganicin 3.4 IOZ	Corlar 3.2 PR or Corlar 2.1PR	Imron 3.5 HG	DuPont Company DuPont Building 1007 Market Street Wilmington, DE 19898 800/441-7515
Porter Zinc 3200	Porter Glaze 4400 High Build	Porterthane 9000 Gloss Urethane	Porter Paint Company 400 South 13th Street Louisville, KY 40203 800/332-6270

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Coating Hazards

Ensure that employees are trained in all aspects of the safety plan. Specified coatings may have potential health hazards if ingested or improperly handled. Follow the coating manufacturer's written safety precautions throughout mixing, application, and curing of the coatings. During all cleaning, cleanup, surface preparation, and paint application phases, ensure that employees are protected from toxic and hazardous chemical agents which exceed concentrations in 29 CFR 1910.1000. Comply with respiratory protection requirements in 29 CFR 1910.134.

3.1.2 Surface Preparation

For faying surfaces that become inaccessible after installation, abrasive blast and coat with inorganic zinc only, prior to installation.

Leave surfaces to be welded uncoated. Welded areas are then masked and

touched up.

Coat prepared surfaces within 6 hours after completion of surface preparation and before rusting or recontamination occurs. Re-prepare surfaces not coated within 6 hours or which show rusting or contamination, regardless of the length of time after preparation.

Sequence surface preparation and coating operations so that freshly applied coatings are not contaminated by dust or foreign matter.

Inspect and degrease surfaces as required prior to subsequent surface preparation and the application of protective coatings. Degreasing is by solvent cleaning, detergent washing, or steam cleaning. SSPC SP 1 applies for solvent cleaning.

3.1.3 Abrasive Blasting (AB)

Ensure abrasive blasting conforms to SSPC SP 10/NACE No. 2 and SSPC Painting Manual.

Ensure compressed air used for abrasive blasting is free of moisture and oil.

Surfaces not to be blasted are:

a. Galvanized steel and prefinished surfaces except when specified to be blast-cleaned in the coating schedule

Maintain a minimum nozzle pressure of 90 pounds per square inch.

Remove weld slag, weld spatter, and foreign matter from surfaces to be coated prior to abrasive blasting using mechanical methods as specified.

Ensure blast cleaning achieves a 1-to 2-mil anchor profile as indicated by a surface profile comparator, replica tape, or similar device.

Remove rust and corrosion from pits and depressions.

Do not reuse abrasive blast aggregate.

Remove all traces of abrasive residue and dust from the surface, leaving it clean and dry.

3.1.4 Mechanical Cleaning (MC)

Where mechanical cleaning is specified in the coating schedule for existing surfaces, use needle scalers or abrasive disks or wheels in accordance with SSPC SP 3, leaving the surface cleanliness equivalent to near-white metal (SSPC SP 10/NACE No. 2).

3.2 APPLICATION

3.2.1 General Requirements

Manufacturer's instructions for thinning, mixing, handling, and applying products are considered a part of this specification. In the event of conflict between the requirements of this specification and the manufacturer's recommendations, this specification takes precedence.

Ensure compressed air used for spraying coatings remains free of moisture and oil.

Ensure each coat of material applied is free from runs; sags; blisters; bubbles; mud cracking; variations in color, gloss, and texture; holidays (missed areas); excessive film build; foreign contaminants; and dry overspray.

Do not apply coating when rain is imminent or when the temperature or humidity is outside the limits recommended by the coating manufacturer.

Ensure the surface temperature is at least 5 degrees F above the dew point.

Work coatings thoroughly into all joints, crevices, and open spaces. Pay special attention to welds, cutouts, sharp edges, rivets, crevices, and bolts to ensure proper coverage and thickness.

Protect newly coated surfaces from damage.

Apply coatings by airless or conventional spray. Use airless spraying for uniform large surface areas. Use conventional spraying for small areas of intricate configuration and for touchup. During application of inorganic zinc coating, maintain uniform suspension.

3.2.2 Mixing and Application Procedures

Stir material thoroughly using an instrument that does not induce air into coating.

Strain mixed material through a 30- to 60-mesh screen.

Provide continuous slow agitation of the material during application of inorganic zinc coating, maintain uniform suspension. Avoid continuous rapid agitation.

Thin material for workability and improved spray characteristics only.

Apply material in even, parallel passes, overlapping 50 percent. Pay special attention to welds, cutouts, sharp edges, rivets, crevices, and bolts to ensure proper coverage and thickness.

3.2.3 Dry-Film Thickness (DFT)

Apply coatings to the following dry-film thicknesses:

Coating System No. 1:

a. Inorganic primer zinc: 3 to 6 mils, inorganic zinc, as specified in Coating Schedule.

b. Inhibitive polyamide epoxy, second coat: 2 to 4 mils. Top coat 4 mils.

c. Aliphatic polyurethane, third coat: 2 to 4 mils, but sufficient to hide previous coat .

3.2.4 Touch-Up

Touch-up abrasions that occurred during shipment or erection as follows:

a. Ensure surface preparation and coating application conforms to the manufacturer's instructions.

b. Use inorganic zinc for touch-up and repair of inorganic zinc and hot-dip galvanizing.

c. Use inhibitive polyamide epoxy and aliphatic polyurethane for touch-up and repair of coating system No. 2.

3.2.5 Sealant Compound Application

For Coating System No. 1, accomplish caulking after application and cure of inorganic zinc coating.

For Coating System No. 2, accomplish caulking after application and cure of inhibitive epoxy coat and prior to aliphatic polyurethane coat.

Caulk exterior joints, including, but not limited to, the following:

a. Perimeter of faying and bearing surfaces of structural members

b. Joints in members between intermittent welds

c. Perimeter of bearing surfaces between floor plates and supporting members (inside, outside, top, and bottom)

3.3 FIELD QUALITY CONTROL

3.3.1 Inspection

On-site work as described herein is inspected for compliance with this specification by a NACE (National Association of Corrosion Engineers) Certified Coating Inspector provided by the Contractor.

For all protective coatings applied off-site locations, provide full inspection by NACE Certified Coating Inspector. Ensure the inspector is present at the pre-work conference to address necessary clarification of inspection and specification requirements. Report immediately any apparent deviation from the specified requirements or any out of tolerance condition to the Contracting Officer for determination of corrective action. Submit the inspection reports performed by the Coating Inspector.

3.3.2 Inspection Forms

Submit inspection forms at the pre-work conference which are used by the Coating Inspector and forwarded to the Contracting Officer prior to delivery of the coated work to the job site.

3.4 SCHEDULES

3.4.1 Coating Schedule

SURFACE DESCRIPTION	SURFACE PREPARATION	COATING SYSTEM	FINISH COLOR FOR COATING SYSTEM NO. 2	DRY FILM THICKNESS, PRIMER COAT, MM MILS
~~[_____]~~Steel Bollards for Vehicle Protection	~~[_____]~~AB or MC	~~[1] [2]~~2	~~[red] [green]~~ Yellow	3-6

-- End of Section --

SECTION 09 97 23.16

LINSEED OIL PROTECTION OF CONCRETE SURFACES
11/10

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM D235	(2002; R 2012) Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)

1.2 DELIVERY, STORAGE AND HANDLING

Deliver the linseed oil emulsion in original sealed containers that show the designated name, specification number, batch number, date of manufacture, manufacturer's directions, and name of manufacturer.

1.3 ENVIRONMENTAL CONDITIONS

Apply coating when air and concrete temperature are between 35 degrees F and 100 degrees F.

1.4 TRAFFIC CONTROL

Allow no traffic, except sealing equipment, on the treated surface until dry.

1.5 EQUIPMENT

1.5.1 Spray Equipment

Portable, truck mounted, or self-contained, mechanized spray equipment with nozzles designed to produce a flat, overlapping fan-shaped spray pattern. Clean tank interior and spray system prior to use.

1.5.2 Brushes and Rollers

Use brush with sufficient body and length of bristle to spread the compound in a uniform film. Use rollers of a type which do not leave a stippled texture.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Linseed Oil-Mineral Spirits Compound

A blend of 60 percent boiled linseed oil and 40 percent mineral spirits conforming to ASTM D235, Type I, by volume.

2.1.2 Linseed Oil Emulsion

ASTM C309, Type 1.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Prepare hardened concrete surfaces to permit sealer penetration. Use airblasting, sandblasting, waterblasting or other approved methods. Immediately before sealer application, remove dust by airblasting.

3.2 APPLICATION

3.2.1 Rate of Application

3.2.1.1 Hardened Concrete

Two coat application of linseed oil-mineral spirits compound:

a. First Coat: one gallon per 360 square feet.

b. Second Coat: one gallon per 600 square feet. Apply the second coat as soon as the first coat is dry to the touch.

3.2.1.2 Fresh Concrete

Apply one coat linseed oil emulsion before permanent set at the rate of one gallon per 200 square feet.

3.2.2 Method of Application

Apply using spray technique.

-- End of Section --

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SECTION 26 00 00.00 20

BASIC ELECTRICAL MATERIALS AND METHODS
07/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D709	(2017) Standard Specification for Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
IEEE C57.12.28	(2014) Standard for Pad-Mounted Equipment - Enclosure Integrity
IEEE C57.12.29	(2014) Standard for Pad-Mounted Equipment - Enclosure Integrity for Coastal Environments

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2014) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14) National Electrical Code

1.2 RELATED REQUIREMENTS

This section applies to all sections of Division 26 and 33, ELECTRICAL and UTILITIES, of this project specification unless specified otherwise in the individual sections.

1.3 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

b. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.

c. The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

1.4 ELECTRICAL CHARACTERISTICS

Electrical characteristics for this project shall be 480/227v volts secondary, three phase, four wire. Final connections to the power distribution system at the new primary power pole mounted transformers by the utility company (AEP).

1.5 ADDITIONAL SUBMITTALS INFORMATION

Submittals required in other sections that refer to this section must conform to the following additional requirements as applicable.

1.5.1 Shop Drawings (SD-02)

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

1.5.2 Product Data (SD-03)

Submittal shall include performance and characteristic curves.

1.6 QUALITY ASSURANCE

1.6.1 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or

brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in the technical section.

1.6.2.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.6.2.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.8 POSTED OPERATING INSTRUCTIONS

Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

a. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

b. Start up, proper adjustment, operating, lubrication, and shutdown procedures.

c. Safety precautions.

d. The procedure in the event of equipment failure.

e. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.9 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.10 FIELD FABRICATED NAMEPLATES

ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

1.11 WARNING SIGNS

Provide warning signs for the enclosures of electrical equipment including substations, pad-mounted transformers, pad-mounted switches, generators, and switchgear having a nominal rating exceeding 600 volts.

a. When the enclosure integrity of such equipment is specified to be in accordance with IEEE C57.12.28 or IEEE C57.12.29, such as for pad-mounted transformers, provide self-adhesive warning signs on the outside of the high voltage compartment door(s). Sign shall be a decal and shall have nominal dimensions of 7 by 10 inches with the legend "DANGER HIGH VOLTAGE" printed in two lines of nominal 2 inch high letters. The word "DANGER" shall be in white letters on a red background and the words "HIGH VOLTAGE" shall be in black letters on a white background. Decal shall be Panduit No. PPSO710D72 or approved equal.

b. When such equipment is guarded by a fence, mount signs on the fence. Provide metal signs having nominal dimensions of 14 by 10 inches with the legend "DANGER HIGH VOLTAGE KEEP OUT" printed in three lines of nominal 3 inch high white letters on a red and black field.

1.12 ELECTRICAL REQUIREMENTS

Electrical installations shall conform to IEEE C2, NFPA 70, and requirements specified herein.

1.13 INSTRUCTION TO GOVERNMENT PERSONNEL

Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated Government personnel in the adjustment, operation, and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section.

PART 2 PRODUCTS

2.1 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test and the additional requirements specified in the technical sections.

PART 3 EXECUTION

3.1 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in the section specifying the associated electrical equipment.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

-- End of Section --

SECTION 26 05 00.00 40

COMMON WORK RESULTS FOR ELECTRICAL
08/16

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D709	(2017) Standard Specification for Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA OS 1	(2013) Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
NEMA 250	(2014) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA FB 1	(2014) Standard for Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable
NEMA KS 1	(2013) Enclosed and Miscellaneous Distribution Equipment Switches (600 V Maximum)
NEMA PB 1	(2011) Panelboards
NEMA TC 2	(2013) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 3	(2016) Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit and Tubing
NEMA VE 1	(2017) Metal Cable Tray Systems
NEMA WD 6	(2016) Wiring Devices Dimensions Specifications

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA

17-14) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 1	(2005; Reprint Aug 2017) UL Standard for Safety Flexible Metal Conduit
UL 1242	(2006; Reprint Mar 2014) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 489	(2016) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 506	(2017) UL Standard for Safety Specialty Transformers
UL 6	(2007; Reprint Nov 2014) Electrical Rigid Metal Conduit-Steel
UL 870	(2016) UL Standard for Safety Wireways, Auxiliary Gutters, and Associated Fittings

1.2 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE Stds Dictionary.

b. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.

c. Vertical assembly: A vertical assembly is a pole, tower or other such support, mounting hardware, arms, brackets and the load. Load can be a luminaire, siren, loudspeaker or other device. All components of a vertical assembly will be rated by the manufacturer to withstand 135 mph wind loading.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists

SD-03 Product Data

Conduits and Raceways

Wire and Cable

Splices and Connectors

Switches

Receptacles

Outlet Boxes, Pull Boxes and Junction Boxes

Circuit Breakers

Panelboards

Lamps and Lighting Fixtures

Dry-Type Distribution Transformers

Submittal for vertical assemblies will be reviewed by a licensed Mechanical, Civil, or Structural Engineer to determine that the entire assembly will withstand 135 mph wind loading.

SD-06 Test Reports

Continuity Test

Phase-Rotation Tests

Insulation-Resistance Test

SD-08 Manufacturer's Instructions

Manufacturer's Instructions

PART 2 PRODUCTS

2.1 EQUIPMENT

Provide the standard cataloged materials and equipment of manufacturers regularly engaged in the manufacture of the products. For material, equipment, and fixture lists submittals, show manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site.

2.1.1 Conduits and Raceways

2.1.1.1 Rigid Steel Conduit

Provide hot dipped galvanized rigid steel conduit complying with UL 6. Except where installed underground, provide polyvinylchloride (PVC) Schedule 80.

Use threaded fittings for rigid steel conduit.

Use solid gaskets. Ensure conduit fittings with blank covers have gaskets, except in clean, dry areas or at the lowest point of a conduit run where drainage is required.

Provide covers with captive screws and are accessible after the work has been completed.

2.1.1.2 Flexible Metallic Conduit

Ensure flexible metallic conduit is galvanized steel and complies with UL 1.

Ensure fittings for flexible metallic conduit are specifically designed for such conduit.

Provide liquidtight flexible metallic conduit with a protective jacket of PVC extruded over a flexible interlocked galvanized steel core to protect wiring against moisture, oil, chemicals, and corrosive fumes.

Ensure fittings for liquidtight flexible metallic conduit are specifically designed for such conduit.

2.1.1.3 Intermediate Metal Conduit

Ensure intermediate metal conduit is galvanized steel and complies with UL 1242.

2.1.1.4 Rigid Nonmetallic Conduit

Ensure rigid nonmetallic conduit complies with NEMA TC 2 and NEMA TC 3 with a wall thickness not less than Schedule 40.

2.1.1.5 Wireways and Auxiliary Gutters

Ensure wireways and auxiliary gutters are a minimum 4 by 4-inch trade size conforming to UL 870.

2.1.2 Cable Trays

Provide ladder type cable trays conforming to NEMA VE 1.

2.1.3 Wire and Cable

Use copper 600-volt type XHHW for conductors installed in conduit. Ensure all conductors are stranded.

Ensure flexible cable is Type SO and contains a grounding conductor with green insulation.

Ensure conductors installed in plenums are marked plenum rated.

2.1.4 Switches

2.1.4.1 Safety Switches

Ensure safety switches comply with NEMA KS 1, and are the heavy-duty type with enclosure, voltage, current rating, number of poles, and fusing as indicated on the drawings. Ensure switch construction is such that, when the switch handle in the "ON" position, the cover or door cannot be opened. Cover release device is coinproof and so constructed that an external tool is used to open the cover. Make provisions to lock the handle in the "OFF" position. Ensure the switch is not capable of being locked in the "ON" position.

Provide switches of the quick-make, quick-break type and terminal lugs for use with copper conductors.

2.1.5 Receptacles

Provide commercial grade, NEMA 5-20R receptacles, 20A, 125 VAC, 2-pole, 3-wire duplex conforming to NEMA WD 6.

2.1.6 Outlet Boxes, Pull Boxes and Junction Boxes

Ensure outlet boxes for use with conduit systems are in accordance with NEMA FB 1 and ANSI/NEMA OS 1 and are not less than 1-1/2 inches deep. Furnish all pull and junction boxes with screw-fastened covers.

2.1.7 Panelboards

Provide circuit breaker type lighting and appliance branch circuit panelboards in accordance with NEMA PB 1. Bolt circuit breakers to the bus. Plug-in circuit breakers are not acceptable. Provide copper buses of the rating indicated on the drawings, with main lugs or main circuit breaker. Provide all panelboards for use on grounded ac systems with a full-capacity isolated neutral bus and a separate grounding bus bonded to the panelboard enclosure. Ensure panelboard enclosures are NEMA 250, Type 1, in accordance with NEMA PB 1. Provide enclosure fronts with latchable hinged doors.

2.1.8 Circuit Breakers

Ensure circuit breaker interrupting rating is not less than those indicated and in no event less than 10,000 amperes root-mean-square (rms) symmetrical at 480 or 240 volts, respectively. Provide multipole circuit breakers of the common-trip type with a single handle. Molded case circuit breakers are bolt-on type conforming to UL 489.

2.1.9 Lamps and Lighting Fixtures

Manufacturers and catalog numbers shown on the drawings are indicative of the general type desired and are not intended to restrict the selection to fixtures of any particular manufacturer. Fixtures with the same salient features and equivalent light distribution and brightness characteristics, of equal finish and quality, are acceptable. Provide lamps of the proper type and wattage for each fixture.

2.1.10 Manufacturer's Nameplate

Ensure each item of equipment has a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent is not acceptable.

2.1.11 Warning Signs

Provide warning signs for the enclosures of electrical equipment including substations, pad-mounted transformers, pad-mounted switches, generators, and switchgear having a nominal rating exceeding 600 volts.

2.1.12 Dry-Type Distribution Transformers

Ensure that general purpose dry-type transformers with windings 600 volts or less are two-winding, 60 hertz, and self-cooled in accordance with UL 506. Ensure windings have a minimum of two 2-1/2-percent taps above and below nominal voltage.

PART 3 EXECUTION

3.1 PREPARATION

Submit manufacturer's instructions including special provisions required to install equipment components and system packages. Special provisions include impedances, hazards and safety precautions.

Protect metallic materials against corrosion. Do not use aluminum when in contact with earth or concrete and, where connected to dissimilar metal, protect by using approved fittings and treatment. Except where other equivalent protective treatment is specifically approved in writing, provide hot-dip galvanized ferrous metals for items such as, anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous items not made of corrosion-resistant steel.

3.2 INSTALLATION

3.2.1 Conduits, Raceways and Fittings

Ensure that conduit runs between outlet and outlet, between fitting and fitting, or between outlet and fitting does not contain more than the equivalent of three 90-degree bends, including those bends located immediately at the outlet or fitting.

Do not install crushed or deformed conduit. Avoid trapped conduit runs where possible. Take care to prevent the lodgment of foreign material in the conduit, boxes, fittings, and equipment during the course of construction. Clear any clogged conduit of obstructions or replace conduit.

3.2.1.1 Rigid Steel Conduit

Make field-made bends and offsets with approved Hickey bending tool or conduit bending machine. Use long radius conduit for elbows larger than 2-1/2 inches.

3.2.1.2 Flexible Metallic Conduit

Use flexible metallic conduit to connect recessed fixtures from outlet boxes in ceilings, transformers, and other approved assemblies.

Use bonding wires in flexible conduit as specified in NFPA 70, for all circuits. Flexible conduit is not considered a ground conductor.

Make electrical connections to vibration-isolated equipment with flexible metallic conduit.

Use liquidtight flexible metallic conduit in wet and oily locations and to complete the connection to motor-driven equipment.

3.2.1.3 Intermediate Conduit

Make all field-made bends and offsets with approved Hickey bending tool or conduit bending machine. Use intermediate metal conduit only for indoor installations.

3.2.1.4 Rigid Nonmetallic Conduit

Ensure rigid PVC conduit is direct buried.

Install a green insulated copper grounding conductor in conduit with conductors and solidly connect to ground at each end. Size grounding wires in accordance with NFPA 70.

3.2.1.5 Wireway and Auxiliary Gutter

Bolt together straight sections and fittings to provide a rigid, mechanical connection and electrical continuity. Close dead ends of wireways and auxiliary gutters. Plug all unused conduit openings.

Support wireways for overhead distribution and control circuits at maximum 5 -foot intervals.

Ensure auxiliary gutters used to supplement wiring spaces for equipment not contained in a single enclosure contains no switches, overcurrent devices, appliances, or apparatus and is not more than 30 feet long.

3.2.1.6 Surface Raceways and Assemblies

Mount surface raceways plumb and level, with the base and cover secured. Minimum circuit run is three-wire, with one wire designated as ground.

3.2.1.7 Splices and Connectors

Make all splices in AWG No. 8 and smaller with approved insulated electrical type.

Make all splices in AWG No. 6 and larger with indentor crimp-type connectors and compression tools. Wrap joints with an insulating tape that has an insulation and temperature rating equivalent to that of the conductor.

3.2.2 Wiring

Color code feeder and branch circuit conductors as follows:

CONDUCTOR	COLOR AC
Phase A	Brown (480/277V) and Black~~[_____]~~
Phase B	Orange (480/277V) and Red~~[_____]~~
Phase C	Yellow (480/277V) and Blue~~[_____]~~
Neutral	Natural Gray (480/277V) and White (240/120V)~~[White] [Natural Gray]~~
Equipment Grounds	Green with Yellow Stripe (480/277V) and Green (240/120V) ~~[Green] [Green with Yellow Stripe] [Bare]~~

Use conductors up to and including AWG No. 2 that are manufactured with

colored insulating materials. For conductors larger than AWG No. 2, have ends identified with color plastic tape in outlet, pull, or junction boxes.

Splice in accordance with the NFPA 70. Provide conductor identification within each enclosure where a tap, splice, or termination is made and at the equipment terminal of each conductor. Match terminal and conductor identification as indicated.

Where several feeders pass through a common pullbox, tag the feeders to clearly indicate the electrical characteristics, circuit number, and panel designation.

3.2.3 Safety Switches

Securely fasten switches to the supporting structure or wall, utilizing a minimum of four 1/4 inch bolts. Do not use sheet metal screws and small machine screws for mounting. Do not mount switches in an inaccessible location or where the passageway to the switch may become obstructed. Mounting height 5 feet above finished grade, when possible.

3.2.4 Wiring Devices

3.2.4.1 Device Plates

Ensure device plates for switches are suitably engraved with a description of the loads when not within sight of the loads controlled.

Mark device plates and receptacle cover plates for receptacles. Show the circuit number, voltage, frequency, phasing, and amperage available at the receptacle. Use self-adhesive labels having 1/4 inch embossed letters.

Similarly mark device plates for convenience outlets indicating the supply panel and circuit number.

3.2.5 Boxes and Fittings

Provide pullboxes where necessary in the conduit system to facilitate conductor installation. For conduit runs longer than 150 feet or with more than three right-angle bends, install a pullbox at a convenient intermediate location.

Securely mount boxes and enclosures to the building structure using supports that are independent of the conduit entering or leaving the boxes.

3.2.6 Panelboards

Securely mount panelboards so that the top operating handle does not exceed 72-inches above finished grade. Do not mount equipment within 36-inches of the front of the panel. Ensure directory card information is complete and legible.

3.2.7 Dry-Type Distribution Transformers

Connect dry-type transformers with flexible metallic conduit.

3.2.8 Field Fabricated Nameplates

Ensure nameplates conform to ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device, as

specified or as indicated on the drawings. Each nameplate inscription identifies the function and, when applicable, the position. Provide nameplates that are melamine plastic, 0.125-inch thick, white with black center core and a matte finish surface with square corners. Accurately align lettering and engrave into the core. Minimum size of nameplates is 1 by 2.5 inches. Lettering is a minimum of 0.25-inch high normal block style.

3.2.9 Identification Plates and Warnings

Provide identification plates for lighting and power panelboards, disconnect switches.

Install identification plates for all line voltage enclosed circuit breakers, identifying the equipment served, voltage, phase(s) and power source. For circuits 480 volts and above, install conspicuously located warning signs in accordance with OSHA requirements.

3.2.10 Posted Operating Instructions

Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Ensure operating instructions do not fade when exposed to sunlight. Secure instructions to prevent easy removal or peeling.

Ensure each system and principal item of equipment is as specified in the technical sections for use by operation and maintenance personnel. Include the following information with the operating instructions:

a. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

b. Start up, proper adjustment, operating, lubrication, and shutdown procedures.

c. Safety precautions.

d. The procedure in the event of equipment failure.

e. Other items of instruction as recommended by the manufacturer.

3.3 FIELD QUALITY CONTROL

After completion of the installation and splicing, and prior to energizing the conductors, perform wire and cable continuity and insulation tests as herein specified before the conductors are energized.

Provide all necessary test equipment, labor, and personnel to perform the tests, as herein specified.

Isolate completely all wire and cable from all extraneous electrical connections at cable terminations and joints. Use substation and switchboard feeder breakers, disconnects in combination motor starters, circuit breakers in panel boards, and other disconnecting devices to isolate the circuits under test.

Perform insulation-resistance test on each field-installed conductor with respect to ground and adjacent conductors. Applied potential is 500 volts

dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. Take readings after 1 minute and until the reading is constant for 15 seconds. Minimum insulation-resistance values is not less than 25 Megohms for 300 volt rated cable and 100 Megohms for 600 volt rated cable. For circuits with conductor sizes AWG No. 8 and smaller insulation resistance testing is not required.

Perform continuity test to insure correct cable connection end-to-end (i.e correct phase conductor, grounded conductor, and grounding conductor wiring). Repair and verify any damages to existing or new electrical equipment resulting from mis-wiring. Receive approval for all repairs from the Contracting Officer prior to commencement of the repair.

Conduct phase-rotation tests on all three-phase circuits using a phase-rotation indicating instrument. Perform phase rotation of electrical connections to connected equipment in a clockwise direction, facing the source.

Submit test reports in accordance with referenced standards in this section.

Final acceptance requires the successful performance of wire and cable under test. Do not energize any conductor until the final test reports are reviewed and approved by the Contracting Officer.

-- End of Section --

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SECTION 26 05 19.10 10

INSULATED WIRE AND CABLE
05/16

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 1202	(2006; R 2012; CORR 1 2012) Flame-Propagation Testing of Wire and Cable

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-58-679	(2014) Control, Instrumentation and Thermocouple Extension Conductor Identification
ICEA T-30-520	(1986) Conducting Vertical Cable Tray Flame Tests with Theoretical Heat Input Rate of 70,000 B.T.U./Hour

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA WC 71/ICEA S-96-659	(2014) Standard for Nonshielded Cables Rated 2001-5000 Volts for use in the Distribution of Electric Energy
NEMA WC 26	(2008) Binational Wire and Cable Packaging Standard
NEMA WC 57	(2014) Standard for Control, Thermocouple Extension, and Instrumentation Cables
NEMA WC 70	(2009) Power Cable Rated 2000 V or Less for the Distribution of Electrical Energy--S95-658
NEMA WC 74/ICEA S-93-639	(2012) 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 1685	(2015) UL Standard for Safety Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables
UL 2556	(2015) UL Standard for Safety Wire and Cable Test Methods
UL 44	(2014; Reprint Feb 2015) Thermoset-Insulated Wires and Cables

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wire and Cable

Conductors

Cable Manufacturing Data

SD-06 Test Reports

Test Report(s), Inspection Report(s), and Verification Report(s)

1.3 DELIVERY, STORAGE, AND HANDLING

Furnish cables on reels or coils. Each cable and the outside of each reel or coil, must be plainly marked or tagged to indicate the cable length, voltage rating, conductor size, and manufacturer's lot number and reel number. Each coil or reel of cable must contain only one continuous cable without splices. Cables for exclusively dc applications, as specified in paragraph "High-Voltage Test Source," must be identified as such. Shielded cables rated 2,001 volts and above must be reeled and marked in accordance with NEMA WC 26, as applicable. Reels must remain the property of the Contractor.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Wire Table

Furnish wire and cable in accordance with the requirements of the wire table below, conforming to the detailed requirements specified herein.

2.1.2 Rated Circuit Voltages

All power wire and cable must have minimum rated circuit voltages in accordance with NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659, or NEMA WC 74/ICEA S-93-639 as applicable. Power wire and cable for circuit

voltages rated 0-600 volts must be rated not less than 600 volts. Control wire and cable must have minimum rated circuit voltages in accordance with NEMA WC 57, but must be rated 600 volts if routed in raceway with other conductors that are rated 600 volts.

2.1.3 Conductors

2.1.3.1 Material for Conductors

Conductors must conform to all the applicable requirements of NEMA WC 57, NEMA WC 70, ANSI/NEMA WC 71/ICEA S-96-659, or NEMA WC 74/ICEA S-93-639 as applicable. Copper conductors must be annealed copper material and they may be bare, or tin- or lead-alloy-coated, if required by the type of insulation used.

2.1.3.2 Size

Minimum wire size must be No. 12 AWG for power and lighting circuits.

2.1.3.3 Stranding

Conductor stranding classes cited herein must be as defined for control conductors or as defined for 0-2,000 volts power conductors in NEMA WC 70, as applicable. Lighting conductors No. 10 AWG and smaller must be solid or have Class B stranding. All other conductors must have Class B or C stranding.

2.1.3.4 Conductor Shielding

Use conductor shielding for wire and cable as applicable.

2.1.3.5 Separator Tape

Where conductor shielding, strand filling, or other special conductor treatment is not required, a separator tape between conductor and insulation is permitted.

2.1.4 Insulation

2.1.4.1 Insulation Material

Unless specified otherwise or required by NFPA 70, wires in conduit, other than service entrance, must be 600-volt, Type XHHW conforming to UL 44. Insulation requirements for wire and cable rated less than 2,000 volts must meet the requirements of NEMA WC 70.

2.1.4.2 Insulation Thickness

2.1.4.2.1 Power Cables, 2,000 Volts and Below

The insulation thickness for single-conductor and multiple-conductor power cables rated 2,000 volts and below must be as required by NEMA WC 70, as applicable. Some thicknesses of NEMA WC 70 will be permitted only for single-conductor cross-linked thermosetting polyethylene insulated cables without a jacket. NEMA WC 70 ethylene-propylene rubber-insulated conductors must have a jacket.

2.1.5 Jackets

All cables must have jackets meeting the requirements of NEMA WC 70, as applicable, and as specified herein. Individual conductors of multiple-conductor cables must be required to have jackets only if they are necessary for the conductor to meet other specifications herein. Jackets of single-conductor cables and of individual conductors of multiple-conductor cables, except for shielded cables, must be in direct contact and adhere or be vulcanized to the conductor insulation. Multiple-conductor cables and shielded single-conductor cables must be provided with a common overall jacket, which must be tightly and concentrically formed around the core. Repaired jacket defects found and corrected during manufacturing are permitted if the cable, including jacket, afterward fully meets these specifications and the requirements of the applicable standards.

2.1.5.1 Jacket Material

The jacket must be one of the materials listed below. Variations from the materials required below will be permitted only if approved for each specific use, upon submittal of sufficient data to prove that they exceed all specified requirements for the particular application.

2.1.5.1.1 General Use

Heavy-duty black neoprene	NEMA WC 70~~, ANSI/NEMA WC 71/ICEA S-96-659, or NEMA WC 74/ICEA S-93-639~~
Heavy-duty chlorosulfonated polyethylene	~~NEMA WC 57,~~ NEMA WC 70~~, ANSI/NEMA WC 71/ICEA S-96-659, or NEMA WC 74/ICEA S-93-639~~
Heavy-duty cross-linked (thermoset) chlorinated polyethylene	NEMA WC 70~~, ANSI/NEMA WC 71/ICEA S-96-659, or NEMA WC 74/ICEA S-93-639~~

2.1.5.2 Jacket Thickness

The minimum thickness of the jackets must be not less than 80 percent of the respective nominal thicknesses specified below.

2.1.5.2.1 Single-Conductor Cables

Single-conductor cables must have a jacket thickness as specified in NEMA WC 70 as applicable.

2.2 CABLE IDENTIFICATION

2.2.1 Color-Coding

Insulation of individual conductors of multiple-conductor cables must be color-coded in accordance with ICEA S-58-679, except that colored braids

will not be permitted. Only one color-code method must be used for each cable construction type. Control cable color-coding must be as indicated. Power cable color-coding must be brown/black for Phase A, orange/red for Phase B, yellow/blue for Phase C, white for grounded neutral, and green with yellow stripe/green for an insulated grounding conductor, if included. Other individual conductors must be color-coded as indicated, but such color-coding may be accomplished by applying colored plastic tapes or colored sleeves at terminations.

2.2.2 Dimensional Tolerance

The outside diameters of single-conductor cables and of multiple-conductor cables must not vary more than 5 percent and 10 percent, respectively, from the manufacturer's published catalog data.

PART 3 EXECUTION

3.1 INSTALLATION INSTRUCTIONS

Submit cable manufacturing data. The following information must be provided by the cable manufacturer for each size, conductor quantity, and type of cable furnished:

a. Minimum bending radius, in inches - For multiple-conductor cables, this information must be provided for both the individual conductors and the multiple-conductor cable.

b. Pulling tension and sidewall pressure limits, in pounds.

c. Instructions for stripping semiconducting insulation shields, if furnished, with minimum effort without damaging the insulation.

d. Upon request, compatibility of cable materials and construction with specific materials and hardware manufactured by others must be stated. Also, if requested, recommendations must be provided for various cable operations, including installing, splicing, terminating, etc.

3.2 TEST REPORT(S), INSPECTION REPORT(S), AND VERIFICATION REPORT(S)

3.2.1 Cable Data

Do not begin any wire and cable fabrication until materials are submitted and approved by the Contracting Officer. Submit cable data for approval including, but not limited to, dimensioned sketches showing cable construction and sufficient additional data to show that wire and cable meet the requirements of this Section.

3.2.2 Inspection and Tests

Inspection and tests of wire and cable furnished under these specifications must be made by and at the plant of the manufacturer, and must be witnessed by the Contracting Officer, unless waived in writing. The Government may require or perform further tests before or after installation. Testing in general must comply with NEMA WC 70 as applicable. Specific tests required for particular materials, components, and completed cables must be as specified in the sections of the above standards applicable to those materials, components, and cable types. Tests must also be performed in accordance with the additional requirements specified below. Submit 5 certified copies of test reports.

3.2.2.1 High-Voltage Test Source

Where the applicable standards allow a choice, high-voltage tests for cables to be used exclusively on dc circuits must be made with dc test voltages. Cables to be used exclusively on ac circuits must be tested with ac test voltages. If both ac and dc will be present, on either the same or separate conductors of the cable, ac test voltages must be used.

3.2.2.2 Flame Tests

All cable assemblies must pass either the vertical cable tray flame tests required by ICEA T-30-520 (stated in, but not required by NEMA WC 70), the vertical tray flame propagation test requirements of UL 1685 and IEEE 1202, the wire and cable burning characteristics test of the UL 2556 VW-1 Test, or (for control cables only) the flame test as required by NEMA WC 57. If such tests, however, have previously been made on identical cables, these tests need not be repeated. Instead, certified reports of the original qualifying tests must be submitted. In this case the reports furnished under paragraph "Reports," must include information, identify critical information, and verify that all of each cable's materials, construction, and dimensions are the same as those in the qualifying tests.

3.2.2.3 Independent Tests

The Government may make visual inspections, continuity or resistance checks, insulation resistance readings, power factor tests, or dc high potential tests at field test values. A cable's failure to pass these tests and inspections, or failure to produce readings consistent with acceptable values for the application, will be grounds for rejection of the cable.

3.2.2.4 Reports

Furnish results of tests. No wire or cable must be shipped until authorized. Lot number and reel or coil number of wire and cable tested must be indicated on the test reports.

WIRE TABLE						
Item No.	Size, AWG or kcmil	No. of Conds.	Rated Circuit Voltage	Stranding	Comments	Quantity, m lin ft
~~Class [_____] stranding may be substituted for [______] where indicated by "*".~~						

-- End of Section --

SECTION 26 05 71.00 40

LOW VOLTAGE OVERCURRENT PROTECTIVE DEVICES
02/17

PART 1 GENERAL

Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS applies to work specified in this section.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1	(2008) Electric Meters Code for Electricity Metering

ASTM INTERNATIONAL (ASTM)

ASTM D877/D877M	(2013) Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C57.13	(2016) Requirements for Instrument Transformers

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C78.23	(1995; R 2003) American National Standard for Incandescent Lamps - Miscellaneous Types
NEMA 250	(2014) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA AB 3	(2013) Molded Case Circuit Breakers and Their Application
NEMA FU 1	(2012) Low Voltage Cartridge Fuses
NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2005; Errata 2008) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 489	(2016) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that reviews the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Connection Diagrams

Fabrication Drawings

Control Devices

Protective Devices

SD-03 Product Data

Fuses

Enclosures

Circuit Breakers

Control Devices

Time Switches

Indicating Lights

SD-06 Test Reports

Dielectric Tests

Final Test Reports

SD-07 Certificates

Insulating Oil

SD-08 Manufacturer's Instructions

Control Devices

Protective Devices

SD-10 Operation and Maintenance Data

Circuit Breakers

Time Switches

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Submit connection diagrams showing the relations and connections of control devices and protective devices by showing the general physical layout of all controls, the interconnection of one system (or portion of system) with another, and internal tubing, wiring, and other devices.

Submit fabrication drawings for control devices and protective devices consisting of fabrication and assembly details performed in the factory.

2.2 EQUIPMENT

2.2.1 Circuit Breakers

Provide circuit breakers that conform to UL 489 and NEMA AB 3.

2.2.1.1 Molded-Case Circuit Breakers

Provide molded-case, manually operated, trip-free circuit breakers, with inverse-time thermal-overload protection and instantaneous magnetic short-circuit protection as required. Completely enclose circuit breakers in a molded case, with a factory-sealed, calibrated sensing element to prevent tampering.

Locate thermal-magnetic tripping elements in each pole of the circuit breaker, and provide inverse-time-delay thermal-overload protection and instantaneous magnetic short-circuit protection. Provide an instantaneous magnetic tripping element that is adjustable and accessible from the front of the breaker on frame sizes larger than 100 A.

Size the breaker as required for the continuous-current rating of the circuit. Provide the breaker class as required.

Provide sufficient interrupting capacity of the panel and lighting branch circuit breakers to successfully interrupt the maximum short-circuit current imposed on the circuit at the breaker terminals. Provide circuit breaker interrupting capacities with a minimum of 10,000 A and that conform to NEMA AB 3.

Provide the common-trip-type multipole circuit breakers having a single operating handle and a two-position on/off indication. Provide circuit breakers with temperature compensation for operation in an ambient temperature of 104 degrees F. Provide circuit breakers that have root mean square (rms) symmetrical interrupting ratings sufficient to protect the circuit being supplied. Interrupting ratings may have selective-type tripping (time delay, magnetic, thermal, or ground fault).

Provide a phenolic-composition breaker body capable of having such

accessories as handle-extension, handle-locking, and padlocking devices attached where required.

For meter circuit disconnects, provide circuit breakers of the motor-circuit-protector type that meet the applicable requirements of NFPA 70.

For service disconnection, provide enclosed circuit-breakers with external handles for manual operation. Provide sheet-metal enclosures with hinged covers suitable for surface mounting.

2.2.2 Fuses

Provide a complete set of fuses for all switches and switchgear. Ensure that fuses have a voltage rating of not less than the circuit voltage.

Make no change in continuous-current rating, interrupting rating, or clearing or melting time of fuses unless written permission is first obtained from the Contracting Officer.

Provide nonrenewable-cartridge-type fuses for ratings 30 A, 125 V or less. Provide renewable-cartridge-type fuses for ratings above 30 A 600 V or less with time-delay dual elements, except where otherwise indicated. Ensure that fuses conform to NEMA FU 1.

Install special fuses such as extra-high interrupting-capacity fuses, fuses for welding machines, and capacitor fuses where required. Do not use plug fuses.

Label fuses showing UL class, interrupting rating, and time-delay characteristics, when applicable.

Provide porcelain fuse holders when field-mounted in a cabinet or box. Do not use fuse holders made of such materials as ebony asbestos, Bakelite, or pressed fiber for field installation.

2.2.3 Control Devices

2.2.3.1 Magnetic Contactors

Provide magnetic contactors in accordance with NEMA ICS 1 and NEMA ICS 2 as required for the control of low-voltage, 60-Hz, tungsten-lamp loads, fluorescent-lamp loads, resistance-heating loads, and the primary windings of low-voltage transformers.

Provide core-and-coil assembly that operates satisfactorily with coil voltage between 85 percent and 110 percent of its voltage rating.

Provide contactors that are designed with a normally open holding-circuit auxiliary contact for control circuits, with a rating in accordance with NEMA ICS 1 and NEMA ICS 2.

Furnish solderless pressure wire terminal connectors, or make available for line and load connections to contactors in accordance with NEMA ICS 1 and NEMA ICS 2.

Provide magnetic contactors with a rating in accordance with NEMA ICS 1 and NEMA ICS 2.

2.3 COMPONENTS

2.3.1 Enclosures

2.3.1.1 Equipment Enclosures

Provide enclosures for equipment in accordance with NEMA 250.

Contain equipment that is installed in wet locations in a NEMA Type 4X, watertight, corrosion-resistant, stainless-steel enclosure. Construct the enclosure to prevent entrance of water when tested in accordance with NEMA ICS 6.

2.3.2 Time Switches

Provide astronomic-type time dials that automatically change settings each day, in accordance with the seasonal time changes in sunrise and sunset. Provide astronomic-type dials that have adjustable on and off trippers, for repetitive switching operations at solar time each day and at each day in the year and that make one revolution in a 24-hour period. Provide time dials that are designed to operate in the "ON" position at sunset and be fully adjustable upward in 15-minute intervals throughout each day, and that indicate the day and month of the year. Calibrate the dials in 15-minute intervals over a 24-hour period around its circumference. Provide a method to defeat the switching operation over weekends or up to 6 preselected calendar days each week.

2.3.3 Indicating Lights

2.3.3.1 General-Purpose Type

For indicating lights, provide oiltight instrument devices with threaded base and collar for flush mounting; translucent convex lens; candelabra screw-base lampholder; and 120 V, 6 W, Type S-6 incandescent lamp in accordance with ANSI C78.23. Provide indicating lights that are color-coded in accordance with NEMA ICS 6.

2.4 TESTS, INSPECTIONS, AND VERIFICATIONS

2.4.1 Factory Testing

Obtain factory test results on control and low-voltage protective devices.

PART 3 EXECUTION

3.1 INSTALLATION

Clearly list fuse information on equipment drawings.

Install control devices and protective devices that are not factory-installed in equipment, in accordance with the manufacturer's recommendations. Field-adjust the devices. Perform operation tests on the control and protective devices. Conform requirements for installation of control and protective devices to NFPA 70, NEMA ICS 1, and NEMA ICS 2.

3.2 FIELD QUALITY CONTROL

3.2.1 Tests

Demonstrate the operation and controls of protective devices of non-factory-installed equipment.

Verify tap settings of instrumentation, potential, and current transformers.

Perform dielectric tests on insulating oil in oil circuit breakers before the breakers are energized. Test oil in accordance with ASTM D877/D877M, and provide breakdown voltage that is not less than 25,000 V. Provide manufacturer certification that the oil contains no PCB's, and affix a label to that effect on each breaker tank and on each oil drum containing the insulating oil.

Field-adjust reduced-voltage starting devices to obtain optimum operating conditions. Provide test meters and instrument transformers that conform to ANSI C12.1 and IEEE C57.13.

Do not energize control and protective devices until the results of the recorded test data have been approved by the Contracting Officer. Provide final test reports with a cover letter/sheet clearly marked with the system name, date, and the words final test reports to the Contracting Officer for approval.

-- End of Section --

SECTION 26 09 23.00 40

LIGHTING CONTROL DEVICES
08/16

PART 1 GENERAL

Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS applies to work specified in this section.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ILLUMINATING ENGINEERING SOCIETY (IES)

IES LM-48	(2001) Guide for Testing the Calibration of Locking-Type Photoelectric Control Devices Used in Outdoor Applications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2005; Errata 2008) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures

UNDERWRITERS LABORATORIES (UL)

UL 773	(1995; Reprint Jul 2015) Standard for Plug-In, Locking Type Photocontrols for Use with Area Lighting
UL 98	(2016) UL Standard for Safety Enclosed and Dead-Front Switches

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Photoconductive Control Devices

Installation Drawings

Light-Sensitive Control Devices

Lighting Contactor

SD-06 Test Reports

System Operation Tests

SD-10 Operation and Maintenance Data

Lighting Control System, Data Package 5

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Photoconductive Control Devices

Provide photoconductive control devices in accordance with UL 773. Control lighting luminaires individually by photo-control elements mounted on or adjacent to the heads of the luminaires. Provide molded housing from translucent butyrate or acrylic plastic materials for light-sensitive control devices and fasten to the base with screws. Provide physically and electrically interchangeable light sensitive control devices with three-pole, 3-wire locking plug and receptacle connections to the line, load, and neutral conductors of the lighting circuit.

Provide photoconductive control devices for incandescent, fluorescent, and outdoor lighting luminaires. Include a photoconductive cell, thermal actuator, and snap-action switch in a weatherproof housing. Provide a control device which is, when attached to its mounting, weatherproof and constructed to exclude beating rain, snow, dust, and insects and capable of withstanding 96 percent relative humidity at 122 degrees F for 48 hours under operating conditions.

2.1.1.1 Photoconductive Limit Settings

Provide device that turns on within the limits of plus 100 to minus 50 percent of its setting, over a range of input voltage from 105 to 130 volts at rated frequency and ambient temperature. Device also performs at rated voltage and frequency over a temperature range from minus 85 to plus 122 degrees F, with relative humidities up to 96-percent throughout the temperature range.

Adjust the device to operate within the limits of 0.8 to 1.2 foot-candles. The device is capable of calibration of the turn-on light level over a minimum range from 0.5 to 3.0 foot-candles, and adaptable for calibration up to 10 foot-candles. Do not use a device that has a turn-off light level to turn-on light level ratio that exceeds 5.

2.1.1.2 Device Rating and Accuracy

Rate the devices at 120 or 277 volts, 60 hertz, at a rated ambient temperature of 77 plus or minus 41 degrees F.

Maintain instrument accuracy by proper calibration in accordance with IES LM-48.

2.2 COMPONENTS

2.2.1 Time Control Switches

Install switches with not less than four 1/4 inch bolts. Do not use sheet metal screws.

Provide switches with a time delay in excess of 5 seconds as an available option.

2.2.2 Manual and Safety Switches

Provide Astronomic dial type arranged to turn "ON" at sunset, and turn "OFF" at a sunrise, automatically changing the settings each day in accordance with seasonal changes of sunset and sunrise. Provide a switch rated at 277 volts, having automatically wound spring mechanism to maintain accurate time for a minimum of 7 hours following a power failure, with a time switch that includes a manual on-off bypass switch. Provide surface mounted housing for the time switch, type NEMA 4 (outdoor) enclosure conforming to NEMA ICS 6.

Provide a switch mechanism consisting of a heavy-duty general-purpose precision snap-acting switch, with NEMA ICS 6 Type 4 enclosures, single-pole, single-throw,. Provide with a selector switch having a minimum of three positions: ON, OFF, and AUTOMATIC. Use the automatic position when photoelectric or timer control is desired. Interface the selector switch with the lighting system magnetic contactor to control system activity.

Ensure switches conform to UL 98. Provide a quick-make, quick-break type switch such that a screwdriver is required to open the switch door when the switch is on, with blades visible when the door is open. Coordinate terminal lugs with the wire size.

2.2.3 Lighting Contactor

Provide NEMA ICS 2, mechanically held contactor, rated 480 volts, with coils rated 480 volts. Provide in a NEMA 4 enclosure conforming to NEMA ICS 6. Provide contactors with silver alloy double-break contacts and coil clearing contacts for mechanically held contactor requiring no arcing contacts. Provide contactor with hand-off-automatic selector switch.

2.2.4 Equipment Identification

2.2.4.1 Manufacturer's Nameplate

Provide each item of equipment with a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in an inconspicuous place; the nameplate of the distributing agent is not acceptable.

2.2.4.2 Labels

Provide labeled control devices, clearly marked for operation of specific lighting functions according to type.

Locate markings where readily visible to service personnel, but unseen from normal viewing angles when devices are in place.

PART 3 EXECUTION

3.1 INSTALLATION

Submit installation drawings for control devices in accordance with the manufacturer's recommended instructions for installation.

3.1.1 Time Control Switches

Install switches with not less than four 1/4 inch bolts. Do not use sheet metal screws.

3.1.2 Manual and Safety Switches

Coordinate terminal lugs with the wire size. Securely fasten switches to the supporting structure or wall using not less than four 1/4 inch bolts. Do not use sheet metal screws.

3.1.3 Magnetic Contactors

Install magnetic contactors, mechanically held, electrically operated, conforming to NEMA ICS 1 and NEMA ICS 2, suitable for 480 volts, 3 phase, 60 Hz, with coil voltage of 277 volts. Provide contactors with maximum continuous ampere rating and number of poles as indicated on drawings. For contactors mounted indoors, provide enclosures conforming to NEMA ICS 6, Type 1. Provide each contactor with a spare, normally open auxiliary contact.

Coordinate terminal lugs with the wire size. Securely fasten switches to the supporting structure or wall using not less than four 1/4 inch bolts. Do not use sheet metal screws.

3.2 FIELD QUALITY CONTROL

Perform system operation tests in accordance with referenced standards in this section.

Demonstrate that photoconductive control devices operate satisfactorily in the presence of the Contracting Officer.

3.3 CLOSEOUT ACTIVITIES

Submit operation and maintenance data, lighting control system, data package 5 as specified herein. Show information for all lighting fixtures, control modules, control zones, schematic diagrams and all interconnecting control wire, conduit, and associated hardware.

-- End of Section --

SECTION 26 24 16.00 40

PANELBOARDS
08/16

PART 1 GENERAL

Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS applies to work specified in this section.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2014) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA PB 1	(2011) Panelboards

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-595	(Rev C; Notice 1) Colors Used in Government Procurement

UNDERWRITERS LABORATORIES (UL)

UL 489	(2016) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 67	(2009; Reprint Dec 2016) UL Standard for Safety Panelboards

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

SD-03 Product Data

Panelboards

Directory Card and Holder

SD-06 Test Reports

Continuity Tests

Insulation Tests

SD-07 Certificates

Certification

SD-08 Manufacturer's Instructions

Manufacturer's Instructions

1.3 QUALITY CONTROL

1.3.1 Certification

Ensure the manufacturer of the assembly is the manufacturer of the major components within the assembly and has produced similar electrical equipment for a minimum period of five years.

Provide certification signed by responsible officials of a manufacturer of a product, system, or material attesting that the product, system or material meet specified requirements. Ensure statements are dated after the award of this contract, with the project name, and a list of the specific requirements which it is intended to address.

PART 2 PRODUCTS

2.1 COMPONENTS

2.1.1 Panelboards

Submit detail drawings for the panelboards consisting of fabrication and assembly drawings for all parts of the work in sufficient detail to enable the Government to check conformity with the requirements of the contract documents. Ensure drawings for panelboards indicate details of bus layout, overall physical features, dimensions, ratings, service requirements, and weights of equipment.

Totally enclose power-distribution panelboards and lighting and appliance branch-circuit panelboards in a steel cabinet, dead-front circuit breaker type with copper buses, surface- or flush-mounted as indicated. Ensure panelboards conform to NEMA PB 1 and UL 489. Provide branch circuit panels with buses fabricated for bolt-on type circuit breakers.

Provide an outer door or cover, hinged on one side, on surface-mounted panelboards to provide gutter space access. Provide a center door for circuit breaker switch access only.

Voltage and current rating, number of phases, and number of wires is as indicated on drawings. Provide four-wire distribution panelboards and lighting and appliance branch-circuit panelboards with an isolated full-capacity neutral bus. Ensure panelboards are rated for 240/120-volt, single-phase 277/480-volt, three-phase, 60-hertz current.

Provide three-phase, 4-wire and single-phase, 3-wire distribution lighting and branch circuit panelboards with an isolated full-capacity bus providing spaces for single-pole circuit breaker switches and spaces indicated as spare.

Provide panelboards with a separate grounding bus bonded to the enclosure. Ensure grounding bus is a solid bus bar of rectangular cross section equipped with binding screws for the connection of equipment grounding conductors.

Ensure each panelboard, as a complete unit, has a short-circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule.

Ensure panelboards and main lugs or main breaker have current ratings as shown on the panelboard schedule.

Provide bus bar connections to the branch circuit breakers that are the "distributed phase" or "phase sequence" type. Single-phase, three-wire panelboard busing is such that when any two adjacent single-pole breakers are connected to opposite phases, two-pole breakers can be installed in any location. Three-phase, four-wire busing is such that when any three adjacent single-pole breakers are individually connected to each of the three different phases, two- or three-pole breakers can be installed at any location. Ensure current-carrying parts of the bus assembly are plated. Mains ratings are as shown on drawings.

For mechanical lugs furnished with panelboards, use cast copper or copper alloys of sizes suitable for the conductors indicated.

Use boxes with the manufacturer's standard knockouts and are fabricated of galvanized code-gage sheet steel. Fronts are of code-gage sheet steel furnished with hinged doors with adjustable trim clamps for securing the fronts to the boxes.

Ensure panelboard enclosures are NEMA 250, Type 4X, stainless steel, unless noted otherwise. Provide enclosures with hinged fronts and corrosion-resistant steel pin-tumbler cylinder locks.

Ensure locks are identically keyed and properly tagged. Provide two keys for each enclosure to the Contracting Officer.

Finish panelboards with baked enamel (unless required to be stainless). Finish color is No. 61 gray conforming to FED-STD-595.

2.1.2 Circuit Breakers

Provide molded-case breakers as specified in 26 05 71.00 40 LOW VOLTAGE OVERCORRECT PROTECTIVE DEVICES. Provide breakers with the indicated frame and trip ratings.

Interrupting rating of circuit breakers are as indicated on drawings. If ratings are not shown, the interrupting rating for circuit breakers in 120/240-volt panelboards is not less than 10,000 amperes rms symmetrical, and that for breakers in 277/480-volt panelboards is not less than 25,000 amperes rms symmetrical.

Use bolt-on type breakers. Do not use plug-in type breakers.

Provide shunt trips where indicated.

In branch circuit panelboards, ensure branch circuit breakers feeding convenience outlets have sensitive instantaneous trip settings of not more than 10 times the trip rating of the breaker to prevent repeated arcing

shorts resulting from frayed appliance cords. Provide UL listed single-pole 15- and 20-ampere circuit breakers as "Switching Breakers" at 120 volts ac and 277 volts ac. Provide UL Class A (5-milliampere sensitivity) ground fault circuit protection on 120-volt ac branch circuit as indicated. Tripping of a branch circuit breaker containing ground fault circuit interruption is not to disturb the feeder circuit to the panelboard.

Ensure connections to the bus are bolt-on type.

When multiple wires per phase are specified, furnish the circuit breakers with connectors made to accommodate multiple wires.

Ensure circuit breaker spaces called out on the drawings are complete with mounting hardware to permit ready installation of the circuit breakers.

2.1.2.1 Surge Protection Devices (SPD)

Provide manufacturer standard surge protection device located within panel enclosure housing, where SPD is indicated on the plans. Device shall be as manufactured by the panel manufacturer.

2.1.3 Directory Card and Holder

Provide a directory card on the inside of hinged fronts and doors 0.030-inch thick minimum plastic in a metal frame, with spaces for circuit numbers, outlets controlled, and room numbers. Where hinged fronts or doors are not required, provide the directory card 0.030-inch thick minimum plastic in a metal frame mounted on the left-hand side of the front trim. Ensure the directory card identifies each branch circuit with its respective and numbered circuit breaker.

2.1.4 Precautionary Label

To ensure persons are aware of immediate or potential hazard in the application, installation, use, or maintenance of panelboards, conspicuously mark each panelboard on the trim or dead front shield with the text (or equivalent) **DANGER** symbol. If the panel is supplied with a door, ensure the label is visible when the door is in the open position.

2.2 TESTS, INSPECTIONS, AND VERIFICATIONS

Provide panelboards in compliance with UL 67.

PART 3 EXECUTION

3.1 INSTALLATION

Install panelboards in accordance with the manufacturer's instructions. Fully align and mount panels so that the height of the top operating handle does not exceed 72 inches above grade.

Ensure directory-card information is typewritten in capital letters to indicate outlets controlled and final room numbers served by each circuit and is mounted in holders behind protective covering.

3.2 FIELD QUALITY CONTROL

Do not energize panelboards until the recorded test data has been submitted to and approved by the Contracting Officer.

Demonstrate each panelboard enclosure key operates the enclosure locks in the presence of the Contracting Officer.

Provide test equipment, labor, and personnel as required to perform the tests as specified. Conduct continuity tests using a dc device with buzzer.

Conduct continuity and insulation tests on the panelboards after the installation has been completed and before the panelboard is energized.

Conduct insulation tests on 480-volt panelboards using a 1,000-volt insulation-resistance test set. Record readings every minute until three equal and consecutive readings have been obtained. Ensure resistance between phase conductors and between phase conductors and ground is not less than 50 megohms.

Conduct insulation tests on panelboards rated 300 volts or less using a 500-volt minimum insulation-resistance test set. Record readings after 1 minute and until the reading is constant for 15 seconds. Ensure resistance between phase conductors and between phase conductors and ground is not less than 25 megohms.

Record and submit test data. Include the location and identification of panelboards and megohm readings versus time.

3.3 CLOSEOUT ACTIVITIES

Submit manufacturer's instructions for panelboards including special provisions required to install equipment components and system packages. Provide special notices details impedances, hazards and safety precautions.

-- End of Section --

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SECTION 26 56 00

EXTERIOR LIGHTING
05/13

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO LTS	(2013; Errata 2013) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM B117	(2016) Standard Practice for Operating Salt Spray (Fog) Apparatus

ILLUMINATING ENGINEERING SOCIETY (IES)

IES HB-10	(2011; Errata 2015) IES Lighting Handbook
IES LM-79	(2008) Electrical and Photometric Measurements of Solid-State Lighting Products
IES LM-80	(2015) Measuring Lumen Maintenance of LED Light Sources
IES RP-16	(2010; Addendum A 2008; Addenda B 2009; Addendum C 2016) Nomenclature and Definitions for Illuminating Engineering
IES RP-8	(2014) Roadway Lighting
IES TM-15	(2011) Luminaire Classification System for Outdoor Luminaires
IES TM-21	(2011; Addendum B 2015) Projecting Long Term Lumen Maintenance of LED Light Sources

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C136.13	(2004; R 2009) American National Standard for Roadway Lighting Equipment, Metal Brackets for Wood Poles
ANSI C136.21	(2014) American National Standard for Roadway and Area Lighting Equipment - Vertical Tenons Used with Post-Top-Mounted Luminaires
ANSI C136.3	(2014) American National Standard for Roadway and Area Lighting Equipment Luminaire Attachments
NEMA 250	(2014) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ANSLG C78.377	(2017) Electric Lamps— Specifications for the Chromaticity of Solid State Lighting Products
NEMA C136.31	(2010) American National for Roadway and Area Lighting Equipment - Luminaire Vibration
NEMA C82.77	(2002) Harmonic Emission Limits - Related Power Quality Requirements for Lighting Equipment
NEMA IEC 60529	(2004) Degrees of Protection Provided by Enclosures (IP Code)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14) National Electrical Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15	Radio Frequency Devices

UNDERWRITERS LABORATORIES (UL)

UL 1310	(2011; Reprint Dec 2014) UL Standard for Safety Class 2 Power Units
UL 1598	(2008; Reprint Oct 2012) Luminaires
UL 8750	(2015; Reprint Aug 2017) UL Standard for Safety Light Emitting Diode (LED) Equipment for Use in Lighting Products

1.2 RELATED REQUIREMENTS

Materials not considered to be luminaires or lighting equipment are specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

1.3 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings shall be as defined in IEEE 100 and IES RP-16.

b. For LED luminaire light sources, "Useful Life" is the operating hours before reaching 70 percent of the initial rated lumen output (L70) with no catastrophic failures under normal operating conditions. This is also known as 70 percent "Rated Lumen Maintenance Life" as defined in IES LM-80.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Photometric Plan

LED Luminaire Warranty

SD-02 Shop Drawings

Luminaire drawings

Poles and Mounting Accessories

SD-03 Product Data

LED Luminaires

Luminaire Light Sources

Power Supply Units (Drivers)

Steel poles

Brackets

SD-04 Samples

LED Luminaires

Submit one sample of each luminaire type, complete with light source power supply unit. Sample will be returned to the Contractor for installation in the project work.

SD-05 Design Data

Design Data for luminaires

SD-06 Test Reports

LED Luminaire - IES LM-79 Test Report

LED Light Source - IES LM-80 Test Report

Operating test

Submit operating test results as stated in paragraph entitled "Field Quality Control."

SD-07 Certificates

Luminaire Useful Life Certificate

Submit certification from the manufacturer indicating the expected useful life of the luminaires provided. The useful life shall be directly correlated from the IES LM-80 test data using procedures outlined in IES TM-21. Thermal properties of the specific luminaire and local ambient operating temperature and conditions shall be taken into consideration.

1.5 QUALITY ASSURANCE

1.5.1 Drawing Requirements

1.5.1.1 Luminaire Drawings

Include dimensions, effective projected area (EPA), accessories, and installation and construction details. Photometric data, including zonal lumen data, average and minimum ratio, aiming diagram, and computerized candlepower distribution data shall accompany shop drawings.

1.5.1.2 Poles and Mounting Accessories

Include dimensions, wind load determined in accordance with AASHTO LTS, pole deflection, pole class, and other applicable information. Include design drawing of pole with proposed luminaire mounting accessories. Pole and mounting accessories shall be designed such that light fixture is pushed out from pole over the bollard fence to ensure there is no light shadowing on the river side of the bollard fence. Create and submit drawings of pole and mounting accessories. Mounting configuration and accessories shop drawings shall be signed and sealed by a registered Professional Engineer in the State of Texas.

1.5.2 Photometric Plan

For LED luminaires, include computer-generated photometric analysis of the "designed to" values for the "end of useful life" of the luminaire installation using a light loss factor of 0.7.

a. Vertical illuminance measurements at 5 feet above finished grade. Measurement grid shall be 5 feet by 5 feet across the entire surface of the enforcement zone boundary, for each boundary condition (50 feet, 75 feet, and 150 feet zones).

b. Minimum and maximum footcandle levels.

c. Average maintained footcandle level.

d. Maximum to minimum ratio for horizontal illuminance only.

In order to meet project requirements, contractor must submit computer generated point-by-point photometric analysis of maintained photopic light levels, indicating that the conditions outlined on the project drawings are satisfied. Include the following at a minimum:

1.5.3 Design Data for Luminaires

a. Provide distribution data according to IES classification type as defined in IES HB-10.

b. Shielding as defined by IES RP-8 or B.U.G. rating for the installed position as defined by IES TM-15.

c. Provide safety certification and file number for the luminaire family. Include listing, labeling and identification per NFPA 70 (NEC). Applicable testing bodies are determined by the US Occupational Safety Health Administration (OSHA) as Nationally Recognized Testing Laboratories (NRTL) and include: CSA (Canadian Standards Association), ETL (Edison Testing Laboratory), and UL (Underwriters Laboratories).

d. Provide long term lumen maintenance projections for each LED luminaire in accordance with IES TM-21. Data used for projections shall be obtained from testing in accordance with IES LM-80.

e. Provide wind loading calculations for luminaires mounted on poles. Weight and effective projected area (EPA) of luminaires and mounting brackets shall not exceed maximum rating of pole as installed in particular wind zone area.

f. Provide certification data that luminaire complies with "dark-sky" requirements.

1.5.4 LED Luminaire - IES LM-79 Test Report

Submit test report on manufacturer's standard production model luminaire. Submittal shall include all photometric and electrical measurements, as well as all other pertinent data outlined under "14.0 Test Report" in IES LM-79.

1.5.5 LED Light Source - IES LM-80 Test Report

Submit report on manufacturer's standard production LED package, array, or module. Submittal shall include:

a. Testing agency, report number, date, type of equipment, and LED light source being tested.

b. All data required by IES LM-80.

1.5.5.1 Test Laboratories

Test laboratories for the IES LM-79 and IES LM-80 test reports shall be one of the following:

a. National Voluntary Laboratory Accreditation Program (NVLAP) accredited for solid-state lighting testing as part of the Energy-Efficient Lighting Products laboratory accreditation program.

b. One of the qualified labs listed on the Department of Energy - Energy Efficiency & Renewable Energy, Solid-State Lighting web site.

c. A manufacturer's in-house lab that meets the following criteria:

   1. Manufacturer has been regularly engaged in the design and production of high intensity discharge roadway and area luminaires and the manufacturer's lab has been successfully certifying these fixtures for a minimum of 15 years.

   2. Annual equipment calibration including photometer calibration in accordance with National Institute of Standards and Technology.

1.5.6 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.5.7 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.7.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if the manufacturer has been regularly engaged in the design and production of high intensity discharge roadway and area luminaires for a minimum of 15 years. Products shall have been in satisfactory commercial or industrial use for 15 years prior to bid opening. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 15-year period.

1.5.7.2 Material and Equipment Manufacturing Date

Products manufactured more than 1 year prior to date of delivery to site shall not be used, unless specified otherwise.

1.6 DELIVERY, STORAGE, AND HANDLING OF POLES

1.6.1 Steel Poles

Do not store poles on ground. Support poles so they are at least one foot above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.7.1 LED Luminaire Warranty

Provide Luminaire Useful Life Certificate.

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

a. Provide a written five year on-site replacement warranty for material, fixture finish, and workmanship. On-site replacement includes transportation, removal, and installation of new products.

   1. Finish warranty shall include warranty against failure and against substantial deterioration such as blistering, cracking, peeling, chalking, or fading.

   2. Material warranty shall include:

      (a) All power supply units (drivers).

      (b) Replacement when more than 10 percent of LED sources in any lightbar or subassembly(s) are defective or non-starting.

      (c) All lenses and shielding.

b. Warranty period must begin on date of project acceptance by the Contracting Officer. Contractor shall provide the Contracting Officer signed warranty certificates prior to final payment.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be luminaires, equipment or accessories are specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.2 LED LUMINAIRES

UL 1598, NEMA C82.77 and UL 8750. Provide luminaires as indicated in luminaire schedule and XL plates or details on project plans. Provide luminaires complete with light sources of quantity, type, and wattage indicated. All luminaires of the same type shall be provided by the same manufacturer.

2.2.1 General Requirements

a. LED luminaire housings shall be die cast or extruded aluminum. Housings for luminaires other than LED shall be die cast, extruded, or fabricated aluminum. Fabricated aluminum housings shall have all seams and corners internally welded to resist weathering, moisture and dust.

b. LED luminaires shall be rated for operation within an ambient temperature range of minus 22 degrees F to 122 degrees F.

c. Luminaires shall be UL listed for wet locations per UL 1598. Optical compartment for LED luminaires shall be sealed and rated a minimum of IP65 per NEMA IEC 60529.

d. LED luminaires shall produce a minimum efficacy as shown in the following table, tested per IES LM-79. Theoretical models of initial raw LED lumens per watt are not acceptable.

Application	Luminaire Efficacy in Lumens per Watt
Exterior Pole/Arm-Mounted Area and Roadway Luminaires	65
~~Exterior Pole/Arm-Mounted Decorative Luminaires~~	~~65~~
~~Exterior Wall-Mounted Area Luminaires~~	~~60~~
~~Bollards~~	~~35~~
~~Parking Garage Luminaires~~	~~70~~

e. Luminaires shall have IES distribution and NEMA field angle classifications as indicated in luminaire schedule on project plans per IES HB-10.

f. Housing finish shall be baked-on enamel, anodized, or baked-on powder coat paint. Finish shall be capable of surviving ASTM B117 salt fog environment testing for 2500 hours minimum without blistering or

peeling.

g. Luminaires shall not exceed the following IES TM-15 Backlight, Uplight and Glare (B.U.G.) ratings:

1. Maximum Backlight (B) rating shall be B3. Provide house side shielding.

2. Maximum Uplight (U) rating shall be U0.

3. Maximum Glare (G) rating shall be B3. Provide glare reduction shielding.

h. Luminaires shall be fully assembled and electrically tested prior to shipment from factory.

i. The finish color shall be black.

j. Luminaire arm bolts shall be 304 stainless steel or zinc-plated steel.

k. Luminaire assembly, including camera, shall be listed for wet locations by an OSHA NRTL.

l. Thermal Management: Mechanical design of protruding external surfaces shall facilitate hose-down cleaning and discourage debris accumulation. Liquids or other moving parts shall be clearly indicated in submittals, shall be consistent with product testing, and shall be subject to review by Government.

m. The luminaire shall be a DesignLights Consortium (DLC) listed product.n. Incorporate modular electrical connections, and construct luminaires to allow replacement of all or any part of the optics, heat sinks, power supply units, ballasts, surge suppressors and other electrical components using only a simple tool, such as a manual or cordless electric screwdriver.

n. Luminaires shall have a nameplate bearing the manufacturer's name, address, model number, date of manufacture, and serial number securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.

o. Luminaire must pass 3G vibration testing in accordance with NEMA C136.31.

p. All factory electrical connections shall be made using crimp, locking, or latching style connectors. Twist-style wire nuts are not acceptable.

2.2.2 Luminaire Light Sources

2.2.2.1 LED Light Sources

a. Correlated Color Temperature (CCT) shall be in accordance with NEMA ANSLG C78.377:

Nominal CCT: 4000 degrees K: 3985 plus or minus 275 degrees K

b. Color Rendering Index (CRI) shall be:

Greater than or equal to 70 for 4000 degrees K light sources.

c. Color Consistency:

Manufacturer shall utilize a maximum 4-step MacAdam ellipse binning tolerance for color consistency of LEDs used in luminaires.

2.2.3 Power Supply Units (Drivers)

2.2.3.1 LED Power Supply Units (Drivers)

UL 1310. LED Power Supply Units (Drivers) shall meet the following requirements:

a. Minimum efficiency shall be 85 percent.

b. Drive current to each individual LED shall not exceed 600 mA, plus or minus 10 percent.

c. Shall be rated to operate between ambient temperatures of minus 22 degrees F and 122 degrees F.

d. Shall be designed to operate on the voltage system to which they are connected, typically ranging from 120 V to 480 V nominal and shall operate normally for input voltage fluctuation of plus or minus 10 percent.

e. Operating frequency shall be: 50 or 60 Hz.

f. Power Factor (PF) shall be greater than or equal to 0.90.

g. Total Harmonic Distortion (THD) current shall be less than or equal to 20 percent.

h. Shall meet requirements of 47 CFR 15, Class B.

i. Shall be RoHS-compliant.

j. Shall be mounted integral to luminaire. Remote mounting of power supply is not allowed.

k. Power supplies in luminaires mounted under a covered structure, such as a canopy, or where otherwise appropriate shall be UL listed with a sound rating of A.

l. Shall be equipped with over-temperature protection circuit that turns light source off until normal operating temperature is achieved.

2.2.4 LED Luminaire Surge Protection

Provide surge protection integral to luminaire to meet C Low waveforms as defined by IEEE C62.41.2, Scenario 1, Location Category C.

2.3 POLES

Provide poles designed for wind loading of 100 miles per hour determined in accordance with AASHTO LTS while supporting luminaires and all other appurtenances indicated. The effective projected areas of luminaires and appurtenances used in calculations shall be specific for the actual products provided on each pole. Poles shall be anchor-base type designed

for use with underground supply conductors. Poles shall have oval-shaped handhole having a minimum clear opening of 2.5 by 5 inches. Handhole cover shall be secured by stainless steel captive screws and tack welded after final installation. Metal poles shall have an internal grounding connection accessible from the handhole near the bottom of each pole. Scratched, stained, chipped, or dented poles shall not be installed.

2.3.1 Steel Poles

AASHTO LTS. Provide steel poles having minimum 11-gage steel with minimum yield/strength of 48,000 psi and hot-dipped galvanized in accordance with ASTM A123/A123M factory finish. Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire. Pole shall be anchor bolt mounted type. Poles shall have tapered tubular members, either round in cross section or polygonal. Pole shafts shall be one piece. Poles shall be welded construction with no bolts, rivets, or other means of fastening except as specifically approved. Pole markings shall be approximately 3 to 4 feet above grade and shall include manufacturer, year of manufacture, top and bottom diameters, and length. Base covers for steel poles shall be structural quality hot-rolled carbon steel plate having a minimum yield of 36,000 psi.

2.4 BRACKETS AND SUPPORTS

ANSI C136.3, ANSI C136.13, and ANSI C136.21, as applicable. Pole brackets shall be not less than 1 1/4 inch galvanized steel pipe secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets shall be coordinated to luminaires provided, and brackets for use with one type of luminaire shall be identical. Brackets for pole-mounted street lights shall correctly position luminaire no lower than mounting height indicated. Mount brackets not less than 24 feet above street. Special mountings or brackets shall be as indicated and shall be of metal which will not promote galvanic reaction with luminaire head.

2.5 POLE FOUNDATIONS

Anchor bolts shall be steel rod having a minimum yield strength of 50,000 psi; the top 12 inches of the rod shall be galvanized in accordance with ASTM A153/A153M. Concrete shall be as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

2.6 EQUIPMENT IDENTIFICATION

2.6.1 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.6.2 Labels

Provide labeled luminaires in accordance with UL 1598 requirements. Luminaires shall be clearly marked for operation of specific light sources and ballasts according to proper light source type.

a. Correlated color temperature (CCT) and color rendering index (CRI) for all luminaires.

Markings related to lamp type shall be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when lamps are in place.

2.7 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.

3.1.1 Steel Poles

Provide pole foundations with galvanized steel anchor bolts, threaded at the top end and bent 90 degrees at the bottom end. Provide ornamental covers to match pole and galvanized nuts and washers for anchor bolts. Concrete for anchor bases, polyvinyl chloride (PVC) conduit ells, and ground rods shall be as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath and the end of conduit ell. Adjust poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.

3.1.2 GROUNDING

Ground noncurrent-carrying parts of equipment including metal poles, luminaires, mounting arms, brackets, and metallic enclosures as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.1.3 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria.

3.2 FIELD QUALITY CONTROL

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Conduct an operating test after 100 hours of burn-in time to show that the equipment operates in accordance with the requirements of this section.

-- End of Section --

SECTION 26 56 13.00 40

LIGHTING POLES AND STANDARDS
11/14

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO LTS	(2013; Errata 2013) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A36/A36M	(2014) Standard Specification for Carbon Structural Steel

ILLUMINATING ENGINEERING SOCIETY (IES)

IES HB-10	(2011; Errata 2015) IES Lighting Handbook

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 81	(2012) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C136.3	(2014) American National Standard for Roadway and Area Lighting Equipment Luminaire Attachments

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14) National Electrical Code

1.2 DEFINITIONS

Groundline section is that portion between one foot above and 2 feet below the groundline. Refer to IEEE Stds Dictionary for additional related definitions and terminology.

1.3 ADMINISTRATIVE REQUIREMENTS

1.3.1 Pre-Installation Meetings

Within 30 calendar days after date of award, submit for the approval of the Contracting Officer six (6) copies of specified drawings of all equipment to be furnished under this contract, together with weights and overall dimensions. Submit the following data and drawings:

a. Poles

b. Installation details

c. Steel poles

d. Brackets

e. Anchorage systems

After submittals are received and approved the Contracting Officer will hold a pre-work conference to review the following:

a. The drawings, including poles, showing complete Installation Details, and specifications. Include details for the following for review:

    (1) Foundation requirements
    (2) Anchorage systems
    (3) Manufacturer's catalog data including mounting and bracket details
    (4) Factory color finish

b. Finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

c. Methods and procedures related to pole and luminaire installation, including manufacturer's written instructions and verification of pole system assembly wind load classification listings.

d. Governing regulations and requirements for insurance, certificates, tests and inspections if applicable. Include certification for sustainable acquisition and pole system assembly wind load rating classification. Safety plan review includes applicable Safety Data Sheets.

e. Temporary protection requirements for pole assembly during and after

installation.

f. Pole system observation and repair procedures after complete installation.

g. Sample Warranty.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Poles

Installation Details

SD-03 Product Data

Steel Poles

Brackets

Anchorage Systems

SD-05 Design Data

Lighting Standards

Manufacturer's Catalog Data

Manufacturer's Color Charts and Chips

Factory Color Finish

Safety Data Sheets

SD-08 Manufacturer's Instructions

Foundation Requirements

Mounting Details

SD-11 Closeout Submittals

Warranty

Record Drawings

1.5 QUALITY CONTROL

1.5.1 Drawing Requirements

1.5.1.1 Poles

Include dimensions, wind load determined in accordance with AASHTO LTS, pole deflection, pole class, and other applicable information conforming to IES HB-10.

1.5.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Provide equipment, materials, installation, and workmanship in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.5.3 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.3.1 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not allowed, unless specified otherwise.

1.5.4 Manufacturer's Color Charts and Chips

Submit manufacturer's color charts and chips, approximately 4 by 4 inches, showing full range of colors, textures and patterns available for poles with factory applied finishes.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle poles and all related accessories and other manufactured items in a manner to prevent damage or deformation.

1.6.1 Steel Poles

Do not store poles on ground. Support poles so they are at least one foot above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

1.7 WARRANTY

Provide support for the equipment items by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship, which have been in satisfactory commercial or industrial use for 2 years prior to bid opening under similar circumstances and of similar size, and have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section. Submit 6 copies of all mounting details.

Products and materials not considered to be lighting equipment or lighting fixture accessories are specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.2 COMPONENTS

2.2.1 Lighting Standards

Lighting standard, includes pole, anchor base, transformer base, brackets, and accessories, designed to withstand vertical and horizontal loading on the entire structure and supported equipment without damage or permanent deformation to any component of the lighting standard.

2.2.2 Poles

Provide poles designed for wind loading of 100 miles per hour determined in accordance with AASHTO LTS while supporting luminaires and all other appurtenances indicated. Provide effective projected areas of luminaires and appurtenances used in calculations specific to the actual products provided on each pole. Provide anchor type bases designed for use with underground supply conductors. Provide an oval-shaped handhole having a minimum clear opening of 2.5 by 5-inches. Secure handhole cover with stainless steel captive screws and tack weld closed after final installation. Provide metal poles with an internal grounding connection accessible from the handhole near the bottom of each pole. Do not install scratched, stained, chipped, or dented poles.

2.2.2.1 Steel Poles

Provide continuously tapered and seam welded steel lighting standards, conforming to AASHTO LTS. Provide steel poles having minimum 11-gage steel with minimum yield/strength of 48,000 psi and hot-dipped galvanized in accordance with ASTM A123/A123M factory finish.

a. Pole Mounting

Provide anchor bolt mounted type pole, with tapered tubular construction, either round in cross section or polygonal. Provide one piece pole shafts, of welded construction with no bolts, rivets, or other means of fastening except as specifically approved.

b. Accessories

Provide accessories, including cast-steel ornamental pole-top cap, pole-top tenons, galvanized nuts, bolts, and washers, and galvanized sheet metal leveling shims.

c. Pole Markings

Provide pole markings approximately 3 to 4-feet above grade, to include manufacturer, year of manufacture, top and bottom diameters, and length.

d. Steel Standard Finish

Clean all exposed metal surfaces of steel lighting standards, including anchor bases, transformer bases, brackets, and other uncoated steel component parts, and apply a prime coat and two finish coats of paint as follows:

2.2.3 Brackets And Supports

Provide brackets and supports conforming to ANSI C136.3, as applicable, with pole brackets not less than 1 1/4-inch galvanized steel pipe secured to pole. Slip-fitter or pipe-threaded brackets may be used, if brackets are coordinated to luminaires provided. Provide identical brackets for use with one type of luminaire. Provide brackets for pole-mounted street lights which correctly position luminaire no lower than mounting height indicated.

2.2.4 Foundations for Lighting Standards

Provide foundations for lighting standards in accordance with manufacturer's recommendations. Submit Equipment Foundation Data in accordance with referenced standards in this section.

2.2.4.1 Concrete Foundations

Proportion, mix, and place concrete materials to provide a minimum 28-day compressive strength of 3,000 pounds per square inch.

a. Anchor Bolts

Provide galvanized high strength steel rod anchor bolts, with a lower deformed 90 degree bend and threaded top conforming to ASTM A36/A36M, having a minimum yield strength of 50,000 psi; with the top 12-inches of the rod galvanized in accordance with ASTM A153/A153M.

PART 3 EXECUTION

3.1 INSTALLATION

Provide electrical installations conforming to IEEE C2, NFPA 70, and to the requirements specified herein.

3.1.1 Steel Poles

Provide pole foundations with galvanized steel anchor bolts, threaded at the top end and bent 90 degrees at the bottom end. Provide ornamental covers to match pole and galvanized nuts and washers for anchor bolts. Concrete for anchor bases, polyvinyl chloride (PVC) conduit ells, and ground rods are as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Thoroughly compact backfill with compacting arranged to

prevent pressure between conductor, jacket, or sheath and the end of conduit ell. Adjust poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.

3.1.2 Standard Setting

Install standards, with their bases level so that standards are plumb. Once the concrete has cured, set the pole on the foundation, level on the foundation bolts, and secure with the holding nuts. Grout the space between the foundation and the pole base. Conform concrete and grout work to Section 03 30 00 CAST-IN-PLACE CONCRETE. Provide concrete strength of 3000 psi at 28 days.

3.1.3 Grounding

Provide grounding conforming to NFPA 70, the contract drawings, and the following:

a. Provide soft-drawn, stranded copper grounding conductors.

3.1.3.1 Handhole

In each handhole, at a convenient point close to the wall, drive a ground rod into the earth before the floor is poured. Make provision for approximately 4 inches of the ground rod to extend above the floor after pouring. When precast concrete units are used, the top of the ground rod may be below the floor, and bring a No. 1/0 AWG copper ground conductor inside through a watertight sleeve in the wall. Make connection to ground rods by means of bolted-clamp terminals or by an approved fusion-welding process. Neatly and firmly attach ground wires to handhole walls, holding the amount of exposed bare wire to a minimum.

3.1.3.2 Metal Cable Boxes

Connect metal cable boxes for direct-burial cable to adjacent ground rods by wires with current-carrying capacities of at least 20 percent of the spliced phase conductors, but not less than No. 6 AWG.

3.2 FIELD QUALITY CONTROL

3.2.1 Ground Resistance Measurements

Measure the resistance to ground by the fall-of-potential method described in IEEE 81.

3.3 CLOSEOUT ACTIVITIES

3.3.1 Record Drawings

Maintain and keep up to date, a separate set of drawings, elementary diagrams and wiring diagrams of the lighting to be used for "record" drawings, showing all changes and additions to the lighting system. In addition to being complete and accurate, keep this set of drawings separate and do not use for installation purposes. Upon completion of the record

drawings, a representative of the Government will review the as-built work with the Contractor. If the as-built work is not complete, the Contractor will be so advised and complete the work as required.

-- End of Section --

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SECTION 28 08 10

ELECTRONIC SECURITY SYSTEM ACCEPTANCE TESTING
05/16

PART 1 GENERAL

1.1 SUMMARY

This specification defines the process and procedures for initial acceptance testing of electronic security systems (ESS) to include access control, as well as associated power and communications. Requirements to plan, conduct, and document all testing activities are covered along with the Government responsibility to witness testing and review and approve submittals. During the course of the acceptance test, demonstrate that, without exception, the completed and integrated ESS complies with the contract requirements.

1.2 DEFINITIONS

The Government Representative is a qualified individual given specific authority to witness system acceptance testing and evaluate the results.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-05 Design Data

Test Plan

SD-06 Test Reports

Draft Test Report

Final Test Report

SD-07 Certificates

Qualifications

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

1.4.1.1 General

The Test Director and Technician must have prior experience with the specific equipment, hardware and software installed under the contract.

1.4.1.2 Test Director

The Test Director must have at least five years of hands-on ESS experience to include any combination of design, installation, testing and maintenance.

1.4.1.3 Technician

The technician must have at least two years of hands-on experience installing and maintaining ESS field equipment to include sensors, card readers, cameras, local processors, and communications equipment. The Technician must be capable of demonstrating all features and capabilities of ESS field equipment. Qualifications may be met by the individual experience of one technician or by the combined experience of a team of technicians.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 TEST PLAN

Clearly establish the scope for ESS testing prior to beginning testing. Submit a Test Plan that addresses the following topics:

3.1.1 Personnel

Identify the Test Director, Technician, and any other personnel that will be performing test activities.

3.1.2 Equipment

List all equipment that is required to support testing. State the purpose of each piece of equipment. Describe equipment that will be used to enable voice communications between the monitoring location and the field.

3.1.3 Procedures

Provide a step-by-step procedure for conducting each functional test. Describe actions and expected results. Ensure that functional test procedures address performance standards described in contract specifications.

Download example procedures from http://www.wbdg.org/FFC/NAVGRAPH/graphtoc.pdf and review for applicability and completeness. Adapt example procedures to meet specific project requirements and develop additional ones as needed. Follow TEST-MASTERTP0023-005 for Air Force projects.

3.1.4 Special Provisions

Discuss any special test provisions such as facility access, safety, integration with existing systems, and coordination with other work.

3.1.5 Test Logs

Provide logs for recording all data from functional testing and burn-in testing.

Download example logs from http://www.wbdg.org/FFC/NAVGRAPH/graphtoc.pdf and review for applicability and completeness. Adapt example logs to meet specific project requirements and develop additional ones as needed.

3.1.6 Schedule

Provide an overall schedule that includes all testing milestones.

3.2 PRE-ACCEPTANCE TESTING

Conduct a complete test of all field equipment, workstations, and central system hardware and software in accordance with the approved Test Plan. The Test Director must be on site to conduct a pre-test inspection and oversee all testing activities. Prior to testing, visually inspect all ESS components and correct workmanship and neatness deficiencies as needed. During the pre-test inspection, verify the accuracy of redline drawings and update drawings as needed. Conduct testing in two phases - functional testing followed by burn-in testing.

3.2.1 Phased Testing

3.2.1.1 Functional Testing Phase

During the functional testing phase, verify system performance in accordance with approved Test Plan. Record results in approved Test Logs, and provide a written explanation of each failure to include cause, corrective action, and retest result. Continue functional testing until all tests have been successfully completed with no unresolved failures.

3.2.1.2 Burn-In Testing Phase

Begin burn-in testing after successful completion of all functional testing.During the burn-in testing phase, place the ESS in normal operating mode and evaluate system performance for a continuous 72-hour period. During this time, the ESS must be fully functional and programmed such that all features can be exercised and evaluated through normal use. Record all system anomalies in approved Test Logs. Include a description of each anomaly along with any actions taken in response. Immediately correct minor deficiencies observed during the course of testing and continue with burn-in testing. Determine the root cause of any failures and make necessary repairs or modifications to restore full functionality. After a failure is corrected repeat functional tests for components and features associated with the failure, and repeat the entire burn-in testing phase .

3.2.2 Draft Test Report

Prepare and submit a Draft Test Report detailing the results of the testing. Refer to paragraph FINAL TEST REPORT for required content. Include a cover letter signed by the Test Director stating that pre-acceptance testing has been completed and that the system is ready for acceptance testing.

3.3 SYSTEM ACCEPTANCE

Test the ESS in accordance with the approved Test Plan in the presence of the Government Representative to certify acceptable performance. Verify that the total system meets all requirements of the specification and complies with the specified standards.

Begin acceptance testing upon arrival of the Government Representative at the project site. Place the ESS in normal operating mode and evaluate system performance during the testing period. Immediately report any deficiencies observed during testing to the Government Representative and

discuss possible causes and corrective measures. Obtain Government approval prior to making any adjustments, repairs or modifications. The Government retains the right to terminate testing at any time the ESS is found to be incomplete or fails to perform as specified. Such termination of acceptance testing constitutes a FAILED system acceptance test.

3.3.1 Preparation

Notify the Contracting Officer of system readiness 15 days prior to the expected start date of acceptance testing. Prior to acceptance testing, complete all clean-up and patch work requirements. Ensure that security equipment closets and similar areas are free of accumulation of waste materials or rubbish caused by prior installation work.

3.3.2 Personnel

Ensure that the following personnel are on site to perform test activities: Test Director and Technician. Ensure that the Quality Control Manager is on site during acceptance testing.

3.3.3 Visual Inspection

Assist the Government Representative in conducting a visual inspection of ESS equipment and wiring. This inspection will focus on the general neatness and quality of workmanship and compliance with applicable codes and manufacturers' recommended installation methods. Provide a comprehensive listing of installed equipment and software along with a complete set of ESS red line drawings to be used during the inspection. Document deficiencies identified during the inspection.

3.3.4 Functional Testing

Comply with requests from the Government Representative to repeat functional tests performed previously during pre-acceptance testing. The Government reserves the right to request the Contractor to repeat all functional tests or a representative sampling thereof as a means of performance verification. Add all test results to approved Test Logs.

3.3.5 System Activity Reports

Retrieve archived data from the system and provide activity reports as requested by the Government Representative. Reports may address any type of activity to include alarms, portal transactions, and video archives. Assist with analyzing reports to identify trends and anomalies.

3.3.6 Corrective Actions

Correct any deficiencies in coordination with the Government Representative. Maintain a punch list and review status at the end of each day. Work diligently to complete corrective actions the same day that deficiencies are observed. Add deficiencies not corrected on the same day to the rework items list maintained by the Quality Control Manager. Failure to resolve punch list items to the satisfaction of the Government constitutes a FAILED system acceptance test.

3.4 FINAL TEST REPORT

Submit a Final Test Report following the successful completion of acceptance testing to include resolution of all punch list items. Address

the following topics in the Final Test Report:

3.4.1 Summary

Provide a chronological summary of all testing. Describe test activities and results in narrative form.

3.4.2 Personnel

Provide a list of all Contractor and Government personnel who participated in the testing.

3.4.3 Test Logs

Provide all completed test logs along with a test log verification signed by the Test Director.

-- End of Section --

SECTION 28 10 05

ELECTRONIC SECURITY SYSTEMS (ESS)
05/16

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM B32	(2008; R 2014) Standard Specification for Solder Metal
ASTM D709	(2017) Standard Specification for Laminated Thermosetting Materials

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.23	(2010) Electromagnetic Locks

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14) National Electrical Code

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST FIPS 140-2	(2001) Security Requirements for Cryptographic Modules
NIST FIPS 197	(2001) Advance Encryption Standard

U.S. DEPARTMENT OF DEFENSE (DOD)

DODI 8500.01	(2014) Cybersecurity

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15	Radio Frequency Devices

UNDERWRITERS LABORATORIES (UL)

UL 1037	(2016; Reprint Sep 2017) UL Standard for Safety Antitheft Alarms and Devices
UL 1076	(1995; Reprint Mar 2015) Proprietary Burglar Alarm Units and Systems
UL 294	(2018) Access Control System Units
UL 681	(2014) Installation and Classification of Burglar and Holdup Alarm Systems
UL 796	(2016) UL Standard for Safety Printed-Wiring Boards

1.2 SYSTEM DESCRIPTION

Provide a new Electriconic Security System (ESS), including associated equipment and appurtenances, intended to allow access to and control of automated vehicular gates. The system shall be modular, flexible, expandable, and secure. The system shall consist of a master access control system and individual, stand-alone, cellular-connected, access control system at each gate.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

ESS Components
Overall System Schematic

SD-03 Product Data

Access Control System
Access Control Devices
Communications Interface Devices
Radio Frequency Link
Uninterruptible Power Supply (UPS)
Batteries
Component Enclosure

SD-05 Design Data

Backup Battery Capacity Calculations

SD-07 Certificates

Contractor Qualifications
Instructor Qualifications

Data Encryption

SD-10 Operation and Maintenance Data

Training Plan
Training Content
ESS Components and ESS Software: Data Package 4
ESS Software and ESS Components: Data Package 4

Submit data package in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA

SD-11 Closeout Submittals

As-Built Drawings; G

1.4 QUALITY ASSURANCE

1.4.1 Regulatory Requirements

The advisory provisions in each of the publications referred to in this specification are mandatory. Interpret these publications as though the word "must" has been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer.

Equipment, materials, installation, and workmanship must be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and:

a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening and have been utilized in applications of equipment and materials under similar circumstances and of similar size.

b. Have been available on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer.

d. Provide commercial off-the-shelf (COTS) products in which the manufacturer allows a network of qualified distributors to sell, install, integrate, maintain, and repair the hardware and software products that make up the system.

1.4.2.1 Alternative Qualifications

Products having less than a 2 year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.2.2 Material and Equipment Manufacturing Date

Products manufactured more than one year prior to date of delivery to the site are not acceptable.

1.4.2.3 Product Safety

System components are to conform to applicable rules and requirements of NFPA 70. Equip system components with instruction stickers including warnings and cautions describing physical safety, and special or important procedures to be followed in operating and servicing system equipment.

1.4.3 Shop Drawings

1.4.3.1 ESS Components

Submit the ESS Components, Data Package 4 with the ESS Software submittal package in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.Submit drawings that clearly and completely indicate each ESS component function that includes:

a. Termination device points

b. Interconnections required for system operation

c. Interconnections between modules and devices

d. Proposed wireway or conduit systems to be used including:

   (1) Locations

   (2) Sizes

   (3) Types

e. Drawings showing:

   (1) Device locations and spacing

   (2) Mounting and positioning details

   (3) Riser Diagrams with cable sizes and types

   (4) Bill of Materials (Device make, model and quantities)

1.4.3.2 Overall System Schematic

Indicate the relationship of integrated components on one-line diagram and show:

a. Power source

b. System controls

c. Impedance matches

d. Interconnecting wire data including:

   (1) Number

(2) Size

(3) Identification

(4) Maximum lengths

1.4.4 Evidence of Experience and Qualifications

1.4.4.1 Contractor Qualifications

Submit experience and certified qualifications data prior to installation. Show that specific installers who will perform the work have a minimum of 2 years of experience successfully installing ESS of the same type and similar design as specified. Include the names, locations, and points of contact of at least two installations of similar type and design as specified in this document where the installer has installed such systems. Indicate the type of each system installed. Certify that each system has performed satisfactorily in the manner intended for a period of at least 12 months.

1.4.4.2 Instructor Qualifications

Submit the instructor's experience and certified qualifications data prior to installation. Show that the instructor has received a minimum of 24 hours of ESS training from a technical organization such as the National Burglar and Fire Alarm Association, and 2 years experience in installing the specified ESS type.

1.5 Environmental Conditions

1.5.1 Exterior Conditions

Components in enclosures must meet performance requirements when exposed to the following ambient conditions:

1.5.1.1 Temperature

104 degrees F.

1.5.1.2 Pressure

Sea level.

1.5.1.3 Solar Radiation

Six hours of solar radiation per day at dry bulb temperature of 120 degrees F including 4 hours of solar radiation at 104 watts per square foot.

1.5.1.4 Rain

2 inches per hour and 5 inches per hour cyclic with wind plus one period of 12 inches per hour.

1.5.1.5 Humidity

5 to 95 percent.

1.5.1.6 Wind

Continual velocity up to 50 mph with gusts to 66 mph, except that fence sensors must detect intrusions up to 35 mph

1.5.1.7 Acoustical Noise

Components must be suitable for use in high noise areas above 110 dB without adversely affecting their performance. Examples areas include flight lines, runup pads, and generator sites.

1.6 SYSTEM CALCULATIONS AND ANALYSIS

1.6.1 Backup Battery Capacity Calculations

Submit calculations showing that backup battery capacity exceeds sensor operation, communications supervision, and alarm annunciation power requirements for proposed equipment plus 25 percent spare capcity.

1.7 ESS SOFTWARE, DATA PACKAGE 4

Submit the ESS software, Data Package 4 with the ESS Components submittal package in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA. Describe the functions of all software in the software manual and include:

a. All information necessary to enable proper loading, testing, and operation

b. Terms and functions definitions

c. Use of system and application software

d. Procedures for system initialization, start-up and shutdown

e. Alarm reports

f. Reports generation

g. Database format and data entry requirements

h. Directory of all files

i. All communication protocol descriptions, including data formats, command characters, and a sample of each type of data transfer

j. Interface definition

k. List of software keys

1.8 AS-BUILT DRAWINGS

Maintain a separate set of drawings, elementary diagrams, and wiring diagrams of the system to be used for as-built drawings. Keep this set accurately and neatly up-to-date with all changes and additions. This set is not to be used for installation purposes.

Finish the final drawings submitted with the endurance test report in accordance with Section 01 78 00 CLOSEOUT SUBMITTALS for as-built

requirements.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide a complete and integrated electronic security system (ESS) consisting of the following subsystems and features:

a. Access Control System (ACS)

b. Communications System

2.2 PERFORMANCE REQUIREMENTS

Integrate the installed and operating subsystems into the overall ESS system to control access and perform as an entity, as specified below. Provide electronic equipment that complies with 47 CFR 15 and are suitable for the environment where they will be installed.

2.2.1 Growth Capability

Provide capability for modular ESS expansion of inputs, outputs, and keypads modification. Additionally, the system shall be expandable to include digital image/video capture as part of each access event. Software must be able to handle design requirements plus 25 percent spare capacity. Growth capability is not to be limited by the provided products.

2.2.2 Network Certification

Certify all Platform Information Technology (PIT) in accordance with DODI 8500.01 and the individual service implementation policy.

2.2.3 Maintainability

Provide components that can be maintained using commercially available tools and equipment. Arrange and assemble components to be readily accessible to maintenance personnel without compromising system defeat resistance and with no degradation in tamper protection, structural integrity, EMI or RFI attenuation, or line supervision after maintenance when it is performed in accordance with manufacturer's instructions.

2.2.4 Availabilty

Provide components rated for continuous operation. Provide solid-state electronic components mounted on printed circuit boards, conforming to UL 796. Provide boards that are plug-in, quick-disconnect type. Do not impede maintenance with densely packed circuitry. Provide power-dissipating components with safety margins of not less than 25 percent with respect to dissipation ratings, maximum voltages, and current-carrying capacity. Provide solid-state type or hemetically sealed electromechanical type light duty relays and similar switching devices.

2.2.5 Fail-Safe Capability

Provide fail-safe capability in critical elements of the ESS including, but not be limited to, the capability to monitor communication link integrity and to provide self-test. Provide fault annunciation when diminished functional capabilities are detected. Annunciate fail-safe alarms to

clearly distinguish from other types of alarms.

2.2.6 Power Loss Detection

Detect AC and DC power loss and generate an alarm when a critical component of the system experiences temporary or permanent loss of power. Annunciate the alarm to clearly identify the component experiencing power loss.

2.2.7 Controls and Designations

Provide controls and designations as specified in NEMA ICS 1.

2.2.8 Special Test Equipment

Provide all special test equipment, special hardware, software, tools, and programming or initialization equipment needed to start or maintain any part of the system and its components. Special test equipment is defined as any test equipment not normally used in an electronics maintenance facility.

2.2.9 Interchangeability

Use off-the-shelf components which are physically, electrically, and functionally interchangeable with equivalent components as complete items. Equivalent, replacement components must not require new or other component modification. Do not use custom designed or one-of-a-kind items. Interchangeable components or modules must not require trial and error matching in order to meet integrated system requirements, system accuracy, or restore complete system functionality.

2.3 MASTER ACCESS CONTROL SYSTEM (MACS)

Provide a master access control system that supports the configuration and simultaneous monitoring of multiple ACS panels utilizing encrypted cellular data connections. Provide the following features:

a. Management of keypad access codes, individual to each separate ACS

b. Storage of access events, recoding time, date, and code used.

c. Optional storage of digital video for each access event. This shall be considered as a future option only.

d. Storage of other security related events, such as power loss, local panel entry, local keypad entry and loss of signal between components.

e. The events of the ACS are to be viewable as separate or as a combined list of all entry and alarm events.

f. Accessible to government personnel via a secure web-based interface.

2.4 ELECTROMAGNETIC LOCKS

Electromagnetic locks are to contain no moving parts and depend solely upon electromagnetism to secure a portal by generating at least 1200 pounds of holding force. Interface the lock with the local processors without external, internal or functional local processor alteration. Incorporate an end-of-line resistor to facilitate line supervision by the system. Install MOVs to protect the controller from reverse current surges if not

incorporated into the electromagnetic lock or local controller. Provide in accordance of ANSI/BHMA A156.23.

2.4.1 Obstruction Sensors

Provide optical sensors to detect obstructions both within the area of the open gate and the door pocket. Sensors shall open the gate if an obstruction is detected in the drive lane or halt opening, if the door pocket is blocked. Sensors may be wired as part of the door operator or as part of the ACS open/close logic.

2.4.2 Backup Battery

Provide batteries, battery charger and inverter as required to provide 12hrs of backup time for the ACU, Sensors and the electromagnetic lock. Provide maintenance-free lead acis or nickel-cadmium batteries with a minimum normal life of 10 years.

2.4.2.1 Battery Charger

Provide a completely automatic battery charging system, which shall maintain batteries in a fully charged state and be capable of recharging to full capacity within 24 hrs after a full discharge.

2.4.3 Cabinet

Provide a sealed and gasketed, stainless steel cabinet, with a rating of NEMA 4x. Locks installed on component enclosures shall be UL listed, round-key type with three dual, one mushroom, and three plain pin tumblers, or shall have a pick resistance equal to a lock having a combination of five cylinder pin and five-point three-position side bar in the same lock. Keys shall be stamped "U.S. GOVT. DO NOT DUP." Maintenance locks shall be of the one-way key-pull type arranged so that the key can be withdrawn only when the lock is in the locked position. Locks on components for maintenance access shall be keyed alike; only two keys shall be furnished for such locks. Deliver keys, tagged with metal tags, accompanied by a manufacturer's certificate which records the number of each key made.

2.4.4 Radio Frequency Link Communication Systems

Provide a radio-frequency communications system that is capable of actuating the qate operator via keying of a radio microphone. Typical provider: Click2Enter, Inc.

2.5 ACCESS CONTROL SYSTEM (ACS)

Provide a stand-alone access control system at each gate location. The ACS shall be based upon a modular distributed microprocessor architecture complete and ready for operation.

a. The ACS shall grant or deny access or exit based upon:

(1) Keypad identification data

(2) Radio Frequency link communications systems (Click2enter)

(3) Video

(4) Biometric reader identification data

(5) Smart card identification data

(6) Identification technologies combination

(7) Input through the access control devices compared to data stored within the system

(8) Time of day, day of week, and special day and holiday scheduling with card validation override.

b. Decision to grant or deny access shall be based upon individual authorization, specific locations and specific dates and/or times.

c. The ACS shall generate an open signal to the door operator upon successful authentication of keypad code.

d. The ACS shall generate an close signal to the door operator upon an adjustable timeout of no more than 2 minutes.

e. The system shall detect obstructions in both the drive lane or in the door pocket and take the appropriate response to open or stop operation.

f. The system shall provide power to an electromechanical door holder to prevent unauthorized opening.

g. Each entry event shall be logged both locally and at the MACU.

h. Provide the future capability to include photo imaging and/or video for each entry event

i. Provide tamper alarms at the ACU control panel and at each keypad.

j. Provide the capability for the ACU to operate autonomously (due to loss of communications) and to place ACU(s) in an manual off-line mode. In the off-line mode, the ACU(s) must retain a historical summary of all ACU activity transactions, up to the maximum capacity of the ACU memory buffer. Provide the ability for manual operator control of system output relays with the manual functions to energize, de-energize, enable or disable.

k. Provide backup power to the primary power by uninterruptible power supply (UPS).

2.5.1 ACS Programming

Provide software capable of, but not limited to, the following programming:

2.5.1.1 Time Schedules

Provide up to 256 user-definable time schedules. These time schedules are to determine the day(s) and times that access will be granted or a scheduled event is to occur. Any and all of the time schedules are to be available for defining access privileges and scheduled events. Provide ALWAYS and NEVER schedules that cannot be altered or removed from the system. Each user-defined time schedule must have the option of reacting or not reacting to user-defined special days, with the ability to react uniquely to each type of special day.

2.5.1.2 Special Days

Provide an unlimited number of user definable special days to be used for configuring exceptions to the normal operating rules, typically for specifying holiday operating rules. Allow for each special day to be assigned to a user-defined type.

2.5.1.3 ACU Daylight Savings Time Adjustment

Provide a software-configurable, user defined adjustment for Daylight Savings Time. The ACU must not need to be connected to a PC workstation in order for the adjustment to occur.

2.5.1.4 Scheduled Events

Provide the capability for of scheduled unlock periods to allow for keypad-free access.

2.5.1.5 Maximum User Capability

Up to 64,000 individual users per ACS may be given codes and have their access controlled and recorded.

2.5.1.6 Access Groups

Each system user must be assignable to a maximum of 4 of 256 possible access groups. An access group is defined as one or more people who are allowed access to the same areas at the same days and time periods.

2.5.1.7 Active and Expire Dates

Any user may be configured with activation and expiration dates. The user can be assigned to any valid access group and will be activated and expired according to the specified dates.

2.5.1.8 Maximum Use Settings

Any user may be configured with maximum number of uses for that card. The card can be assigned to any valid access group and will be expired according to the specified number of card uses.

2.5.2 Access Control Devices

UL 294. The keypad must meet encryption requirements that are specified in paragraph DATA ENCRYPTION. Devices are to be tamper alarmed, tamper and vandal resistant, and solid state, containing no electronics which could compromise the access control subsystem should the subsystem be attacked.

2.5.2.1 Keypads

Entry control keypads are to use unique numericcombinations as an identifier.

2.5.2.1.1 Keypad Display

Keypads are to include an LED or other type of visual indicator display and provide visual status indications indicating power ON and OFF and whether user passage requests have been accepted or rejected.

2.5.2.1.2 Keypad Power

Power the keypad from the source as shown on the drawings. The keypad must not dissipate more than 5 Watts.

2.5.2.1.3 Keypad Mounting Method

Provide keypads suitable for pedestal, or weatherproof mounting as required. The enclosure for the keypad shall be stainless steel with gaskets for the keypad.

2.6 COMMUNICATIONS

Communications shall link together subsystems of the ESS. ESS communications links shall be via hardwire (cable) or radio frequency. Communications links shall be supervised. Common communications interface devices shall be provided throughout the ESS. Sensor to control unit interface shall be by dry relay contact normally open or normally closed, except as specified otherwise. ACU to MACU reporting shall be encrypted, digital, asynchronous, or multiplexed data

a. Use digitally encrypted, cellular-based, communications from each ACU to the MACU

b. Provide a cellular signal booster at each gate location, with a 100db minimum signal gain.

2.6.1 Data Encryption

Incorporate data encryption equipment on data transmission circuits as shown on the drawings. The algorithm used for encryption must be the Advanced Encryption Standard (AES) algorithm described in NIST FIPS 197 of TDES as a minimum. Data encryption must be in accordance with NIST FIPS 140-2.

2.7 FIELD FABRICATED NAMEPLATES

Nameplates must comply with ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings. Each nameplate inscription is to identify the function and, when applicable, the position.

Nameplates are to be melamine plastic, 0.125 inch thick, white with black center core. Surface is to be matte finish. Corners are to be square. Accurately align lettering and engrave into the core. Minimum size of nameplates must be 1 by 2.5 inches. Provide lettering a minimum of 0.25 inch high normal block style. Nameplates are not be required for devices smaller than 1 x 3 inches.

2.7.1 Manufacturer's Nameplate

Each item of equipment is to have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

PART 3 EXECUTION

3.1 INSTALLATION

Install the system in accordance with safety and technical standards NFPA 70, UL 681, UL 1037, and UL 1076. Configure components within the system with appropriate service points to pinpoint system trouble in less than 20 minutes.

Install all system components, including any equipment that is furnished by the Government, and appurtenances in accordance with the manufacturer's instructions, IEEE C2 and as shown on the drawings, and furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.

3.1.1 Software Installation

Load software as specified and required for an operational system, including databases and specified programs. Provide original and backup copies on optic discs of all accepted software, including diagnostics, upon successful endurance test completion.

3.1.2 Enclosure Penetrations

Enclosures are to be penetrated from the bottom unless shown otherwise. Penetrations of interior enclosures having transitions of conduit from interior to exterior, and penetrations of exterior enclosures are to be sealed with rubber silicone sealant to preclude the entry of water. Terminate conduit risers in a hot-dipped galvanized metal cable terminator that is filled with a sealant as recommended by the cable manufacturer, and in a manner that does not damage the cable.

3.1.3 Cable and Wire Runs

Perform required cable and wire routings per NFPA 70, Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, and as specified. Terminate conduits including flexible metal and armored cable in the sensor or device enclosure. Fit ends of conduit with insulated bushings. Exposed conductors at ends of conduits external to sensors and devices are not acceptable.

3.1.4 Soldering

Soldered electrical connections must use composition Sn60, Type AR or S, for general purposes; use composition Sn62 or Sn63, Type AR or S, for special purposes. Flux must conform to ASTM B32 when Type S solder is used for soldering electrical connections.

3.1.5 Galvanizing

Ferrous metal is to be hot-dip galvanized in accordance with ASTM A123/A123M. Provide screws, bolts, nuts, and other fastenings and supports that are corrosion resistant.

Field welds or brazing on factory galvanized boxes, enclosures, conduits, and so on, are to be coated with a cold galvanized paint containing at least 95 percent zinc by weight.

3.1.6 Underground Cable Installation

Install underground conductors connecting protected structures and objects to the central alarm updating and display unit as direct burial or in conduit as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Coaxial cable cannot be spliced.

3.2 ADJUSTMENT, ALIGNMENT, SYNCHRONIZATION, AND CLEANING

a. Clean each system component of dust, dirt, grease, or oil incurred during and after installation or accrued subsequent to installation from other project activities subsequent to installation.

b. Prepare for system activation by manufacturer's recommended procedures for adjustment, alignment, or synchronization.

c. Prepare each component in accordance with appropriate provisions of component installation, operations, and maintenance manuals.

3.3 SYSTEM STARTUP

Do not apply power to the system until after:

a. Set up system equipment items and communications in accordance with manufacturer's instructions.

b. Conduct a system visual inspection to ensure that defective equipment items have not been installed and that there are no loose connections.

c. Test and verify system wiring as correctly connected.

d. Verify system grounding and transient protection systems as properly installed.

e. Verify the correct voltage, phasing, and frequency of the system power supplies.

Satisfaction of the requirements above does not relieve the contractor of responsibility for incorrect installations, defective equipment items, or collateral damage as result of Contractor work or equipment.

3.4 SUPPLEMENTAL CONTRACTOR QUALITY CONTROL

Provide the services of technical representatives who are familiar with all components and installation procedures of the installed system; and are approved by the Contracting Officer. These representatives are to be present on the job site during the preparatory and initial phases of quality control to provide technical assistance. These representatives are also to be available on an as needed basis to provide assistance with follow-up phases of quality control. These technical representatives are to participate in the system testing and validation and provide certification that their respective system portions meet the contractual requirements.

The above requirements supplement the quality control requirements specified elsewhere in the contract.

3.5 ESS SYSTEM TESTING

All ESS Testing requirements are specified in Section 28 08 10 ELECTRICAL SECURITY SYSTEM ACCEPTANCE TESTING.

3.6 ESS TRAINING

Conduct training courses for 10 designated personnel in system maintenance and operation. Coordinate training with the Government. The training is to be oriented to the specific system being installed. Training content is to include training manuals and audio-visual materials. Deliver training manuals for each trainee with 2 additional copies delivered for archiving at the project site. The manuals are to include an agenda, defined objectives for each lesson, and a detailed subject matter description for each lesson.

Furnish audio-visual equipment and other training materials and supplies. Deliver copies of the audio-visual materials to the Government either as a part of the printed training manuals or on the same media as that used during the training sessions when course portions are presented using audio-visual material.

3.6.1 ESS Training Outline

Submit a training plan for the training phases, including type of training to be provided, outline of training manuals, training course agendas, and a list of reference material, for Government approval.

3.6.2 Typical Training Day

A training day is defined as:

a. Eight hours of classroom instruction, with

  (1) Two 15-minute breaks

  (2) One hour lunch break

b. Conducted:

  (1) Monday through Friday

  (2) During the daytime shift in effect at a Government-provided training facility

For guidance in planning the required instruction, assume that attendees will have a high school education or equivalent, and are familiar with ESS. Approval of the planned training schedule is to be obtained from the Government at least 30 days prior to the training.

3.7 NAMEPLATE MOUNTING

Provide nameplate number, location, and letter designation as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or rivets.

-- End of Section --

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SECTION 31 00 00

EARTHWORK
08/08

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(2017) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
AASHTO T 224	(2010) Standard Method of Test for Correction for Coarse Particles in the Soil Compaction Test

ASTM INTERNATIONAL (ASTM)

ASTM C136/C136M	(2014) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D1140	(2017) Standard Test Methods for Determining the Amount of Material Finer than 75-µm (No. 200) Sieve in Soils by Washing
ASTM D1556/D1556M	(2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2434	(1968; R 2006) Permeability of Granular Soils (Constant Head)
ASTM D2487	(2011) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D4318	(2017) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D6938	(2017) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow

	Depth)
ASTM D698	(2012; E 2014; E 2015) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 600/4-79/020	(1983) Methods for Chemical Analysis of Water and Wastes
EPA SW-846.3-3	(1999, Third Edition, Update III-A) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods

1.2 DEFINITIONS

1.2.1 Satisfactory Materials

Satisfactory materials comprise any materials classified by ASTM D2487as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SP-SC, CL, or CL-ML. Satisfactory materials for grading comprise stones less than 3 inches in any dimension.

1.2.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. Notify the Contracting Officer when encountering any contaminated materials.

1.2.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Perform testing, required for classifying materials, in accordance with ASTM D4318, ASTM C136/C136M and ASTM D1140.

1.2.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum density. Since ASTM D1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, express the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve as a percentage of the maximum density in accordance with AASHTO T 180 and corrected with AASHTO T 224. To maintain the same percentage of coarse material, use the "remove and replace" procedure as described in NOTE 8 of Paragraph 7.2 in AASHTO T 180.

1.2.5 Topsoil

Material suitable for topsoils obtained from offsite areas or excavations is defined as: Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.

1.2.6 Hard/Unyielding Materials

Hard/Unyielding materials comprise weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" with stones greater than 3 inch in any dimension or as defined by the pipe manufacturer, whichever is smaller. These materials usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.2.7 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.2.8 Unstable Material

Unstable materials are too wet to properly support the utility pipe, conduit, or appurtenant structure.

1.2.9 Select Granular Material

1.2.9.1 General Requirements

Select granular material consist of materials classified as GW, GP, SW, SP, by ASTM D2487 where indicated. The liquid limit of such material must not exceed 35 percent when tested in accordance with ASTM D4318. The plasticity index must not be greater than 2 percent when tested in accordance with ASTM D4318, and not more than 35 percent by weight may be finer than No. 200 sieve when tested in accordance with ASTM D1140. Provide a minimum coefficient of permeability of 0.002 feet per minute when tested in accordance with ASTM D2434.

1.2.10 Initial Backfill Material

Initial backfill consists of select granular material or satisfactory materials free from rocks 3 inches or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller.

1.2.11 Expansive Soils

Expansive soils are defined as soils that have a plasticity index equal to or greater than 25 when tested in accordance with ASTM D4318.

1.2.12 Pile Supported Structure

As used herein, a structure where both the foundation and floor slab are pile supported.

1.3 SYSTEM DESCRIPTION

Subsurface soil boring logs are appended to the SPECIAL CONTRACT REQUIREMENTS, including the subsoil investigation report. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.3.1 Classification of Excavation

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.3.2 Blasting

Blasting will not be permitted.

1.3.3 Dewatering Work Plan

Submit procedures for accomplishing dewatering work.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Shoring

Dewatering Work Plan

SD-03 Product Data

Utilization of Excavated Materials

Opening of any Excavation or Borrow Pit

Rock Excavation

SD-06 Test Reports

Testing

Borrow Site Testing

Within 24 hours of conclusion of physical tests, submit 2 copies of test results, including calibration curves and results of calibration tests.

SD-07 Certificates

Testing

Qualifications of the Contractor's testing facilities

Off-Site Soils

Hazardous, Toxic and Radioactive Waste (HTRW) free

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR OFFSITE SOILS

Test offsite soils brought in for use as backfill for Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and full Toxicity Characteristic Leaching Procedure (TCLP) including ignitability, corrosivity and reactivity. Backfill shall contain a maximum of 100 parts per million (ppm) of total petroleum hydrocarbons (TPH) and a maximum of 10 ppm of the sum of Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and shall pass the TCPL test. Determine TPH concentrations by using EPA 600/4-79/020 Method 418.1. Determine BTEX concentrations by using EPA SW-846.3-3 Method 5030/8020. Perform TCLP in accordance with EPA SW-846.3-3 Method 1311. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site. Offsite soils shall meet the specifications for Initial Backfill of this specification. Provide certificates per ER 1165-2-132 for off-site soils verifying that materials are Hazardous, Toxic and Radioactive Waste (HTRW) free. Copies of all laboratory and field test reports must be submitted to the Contrtacting Officer within 24 hours of the completion of the test. Do not bring material onsite until tests have been approved by the Contracting Officer.

2.2 BURIED WARNING AND IDENTIFICATION TAPE

Provide metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inches minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Provide permanent color and printing, unaffected by moisture or soil.

Warning Tape Color Codes	
Red	Electric
Orange	Telephone and Other Communications
Blue	Water Systems
Green	Sewer Systems

2.2.1 Warning Tape for Metallic Piping

Provide acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.003 inch and a minimum strength of 1500 psi lengthwise, and

1250 psi crosswise, with a maximum 350 percent elongation.

2.2.2 Detectable Warning Tape for Non-Metallic Piping

Provide polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.004 inch, and a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Manufacture tape with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.3 DETECTION WIRE FOR NON-METALLIC PIPING

Insulate a single strand, solid copper detection wire with a minimum of 12 AWG.

2.4 MATERIAL FOR RIP-RAP

Provide Bedding material, Grout, Filter fabric and rock conforming to TXDOT State Standard for construction indicated.

2.4.1 Bedding Material

Provide bedding material consisting of sand, gravel, or crushed rock, well graded, with a maximum particle size of 2 inches. Compose material of tough, durable particles. Allow fines passing the 75 micrometers No. 200 standard sieve with a plasticity index less than six.

2.4.2 Grout

Provide durable grout composed of cement, water, an air-entraining admixture, and sand mixed in proportions of one part portland cement to two parts of sand, sufficient water to produce a workable mixture, and an amount of admixture which will entrain sufficient air, as determined by the Contracting Officer. Mix grout in a concrete mixer. Allow a sufficient mixing time to produce a mixture having a consistency permitting gravity flow into the interstices of the rip-rap with limited spading and brooming.

2.4.3 Rock

Provide rock fragments sufficiently durable to ensure permanence in the structure and the environment in which it is to be used. Use rock fragments free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. Provide fragments sized so that no individual fragment exceeds a weight of 150 pounds and that no more than 10 percent of the mixture, by weight, consists of fragments weighing 2 pounds or less each. Provide rock with a minimum specific gravity of 2.50. Do not permit the inclusion of more than trace 1 percent quantities of dirt, sand, clay, and rock fines.

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Where indicated or directed, strip topsoil to a depth of 4 inches. Spread topsoil on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified.

Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inches in diameter, and other materials that would interfere with planting and maintenance operations. Remove from the site any surplus of topsoil from excavations and gradings.

3.2 GENERAL EXCAVATION

Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Perform the grading in accordance with the typical sections shown and the tolerances specified in paragraph FINISHING. Transport satisfactory excavated materials and place in fill or embankment within the limits of the work. Excavate unsatisfactory materials encountered within the limits of the work below grade and replace with satisfactory materials as directed. Include such excavated material and the satisfactory material ordered as replacement in excavation. Dispose surplus satisfactory excavated material not required for fill or embankment in areas approved for surplus material storage or designated waste areas. Dispose unsatisfactory excavated material in designated waste or spoil areas. It is the responsibility of the Contractor to locate and acquire disposal areas. Spoil areas shall not be located within the floodplain. During construction, perform excavation and fill in a manner and sequence that will provide proper drainage at all times. Excavate material required for fill or embankment in excess of that produced by excavation within the grading limits from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

a. During excavation operations, should material that is suspected of containing hazardous, toxic, or radioactive material be encountered, cease operations immediately in accordance with ER 1165-5-132 and contact the Contracting Officer.

3.2.1 Ditches, Gutters, and Channel Changes

Finish excavation of ditches, gutters, and channel changes by cutting accurately to the cross sections, grades, and elevations shown on the plans. Do not excavate ditches and gutters below grades shown. Backfill the excessive open ditch or gutter excavation with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Dispose excavated material as directed. Maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.2.2 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. Construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit

construction to proceed.

3.2.3 Dewatering

Control groundwater flowing toward or into excavations to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. Do not permit French drains, sumps, ditches or trenches within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Take control measures by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, maintain the water level continuously, at least 4 feet below the working level. Operate dewatering system continuously until construction work below existing water levels is complete. Submit performance records weekly. Measure and record performance of dewatering system at same time each day by use of observation wells or piezometers installed in conjunction with the dewatering system.

3.2.4 Trench Excavation Requirements

Excavate the trench as recommended by the manufacturer of the pipe to be installed. Slope trench walls below the top of the pipe, or make vertical, and of such width as recommended in the manufacturer's printed installation manual. Provide vertical trench walls where no manufacturer's printed installation manual is available. Shore trench walls more than 4 feet high, cut back to a stable slope, or provide with equivalent means of protection for employees who may be exposed to moving ground or cave in. Excavate trench walls which are cut back to at least the angle of repose of the soil. Give special attention to slopes which may be adversely affected by weather or moisture content. Do not exceed the trench width below the pipe top of 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter.

3.2.4.1 Bottom Preparation

Grade the bottoms of trenches accurately to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Remove stones of 2 inch or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, to avoid point bearing.

3.2.4.2 Removal of Unyielding Material

Where unyielding material is encountered in the bottom of the trench, remove such material 6 inch below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.2.4.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, remove such material to the depth directed and replace it to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the Contractor is responsible for excavating the resulting material and replacing it without additional cost to the Government.

3.2.4.4 Excavation for Appurtenances

Provide excavation for manholes, catch-basins, inlets, or similar structures of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Clean rock or loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Remove loose disintegrated rock and thin strata. Specify removal of unstable material. When concrete or masonry is to be placed in an excavated area, take special care not to disturb the bottom of the excavation. Do not excavate to the final grade level until just before the concrete or masonry is to be placed.

3.2.5 Underground Utilities

The Contractor is responsible for movement of construction machinery and equipment over pipes and utilities during construction. Perform work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility company. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

3.2.6 Structural Excavation

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement. Excavate to bottom of pile cap prior to placing or driving piles, unless authorized otherwise by the Contracting Officer. Backfill and compact over excavations and changes in grade due to pile driving operations to 95 percent of ASTM D698 maximum density.

3.3 SELECTION OF BORROW MATERIAL

Select borrow material to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Obtain borrow material from the borrow areas from approved private sources. Unless otherwise provided in the contract, the Contractor is responsible for obtaining the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling from the owners. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, do not obtain borrow within the limits of the project site without prior written approval. Consider necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon related operations to the borrow excavation.

3.4 OPENING AND DRAINAGE OF EXCAVATION AND BORROW PITS

Notify the Contracting Officer sufficiently in advance of the opening of any excavation or borrow pit or borrow areas to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, excavate borrow pits and other excavation areas providing adequate drainage. Transport overburden and other spoil material to designated spoil areas or otherwise dispose of as directed. Provide neatly trimmed and drained borrow pits after the excavation is completed.

Ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.5 SHORING

3.5.1 General RequirementsS

Submit a Shoring and Sheeting plan for approval 15 days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheeting of excavations. Finish shoring, including sheet piling, and install as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Remove shoring, bracing, and sheeting as excavations are backfilled, in a manner to prevent caving.

3.5.2 Geotechnical Engineer

Hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer is responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer is responsible for updating the excavation, sheeting and dewatering plans as construction progresses to reflect changing conditions and submit an updated plan if necessary. Submit a monthly written report, informing the Contractor and Contracting Officer of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Contracting Officer is responsible for arranging meetings with the Geotechnical Engineer at any time throughout the contract duration.

3.6 GRADING AREAS

Where indicated, divide work into grading areas within which satisfactory excavated material will be placed in embankments, fills, and required backfills. Do not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing. Place and grade stockpiles of satisfactoryas specified. Keep stockpiles in a neat and well drained condition, giving due consideration to drainage at all times. Clear, grub, and seal by rubber-tired equipment, the ground surface at stockpile locations; separately stockpile excavated satisfactory and unsatisfactory materials. Protect stockpiles of satisfactory materials from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, remove and replace such material with satisfactory material from approved sources.

3.7 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Do not excavate to final grade until just before concrete is to be placed. Only use excavation methods that will leave the foundation rock in a solid and unshattered condition. Roughen the level surfaces, and cut the sloped surfaces, as indicated, into rough steps or benches to provide a satisfactory bond. Protect shales from slaking and all surfaces from erosion resulting from ponding or water flow.

3.8 GROUND SURFACE PREPARATION

3.8.1 General Requirements

Remove and replace unsatisfactory material with satisfactory materials, as directed by the Contracting Officer, in surfaces to receive fill or in excavated areas. Scarify the surface to a depth of 6 inches before the fill is started. Plow, step, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that the fill material will bond with the existing material. When subgrades are less than the specified density, break up the ground surface to a minimum depth of 6 inches, pulverizing, and compacting to the specified density. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 12 inches and compact it as specified for the adjacent fill.

3.8.2 Frozen Material

Do not place material on surfaces that are muddy, frozen, or contain frost. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Moisten material as necessary to plus or minus 2 percent of optimum moisture.

3.9 UTILIZATION OF EXCAVATED MATERIALS

Dispose unsatisfactory materials removing from excavations into designated waste disposal or spoil areas. Use satisfactory material removed from excavations, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. Do not waste any satisfactory excavated material without specific written authorization. Dispose of satisfactory material, authorized to be wasted, in areas approved for surplus material storage or designated waste areas as approved by the Contracting Officer. Stockpile and use coarse rock from excavations for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. Do not dispose excavated material to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.10 BURIED TAPE AND DETECTION WIRE

3.10.1 Buried Warning and Identification Tape

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

3.10.2 Buried Detection Wire

Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inches above the top of pipe.

3.11 BACKFILLING AND COMPACTION

Place backfill adjacent to any and all types of structures, in successive horizontal layers of loose material not more than 8 inches in depth. Compact to at least 90 percent laboratory maximum density for cohesive

materials or 95 percent laboratory maximum density for cohesionless materials, to prevent wedging action or eccentric loading upon or against the structure. Backfill material must be within the range of -2 to +2 percent of optimum moisture content at the time of compaction.

Prepare ground surface on which backfill is to be placed and provide compaction requirements for backfill materials in conformance with the applicable portions of paragraphs GROUND SURFACE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.11.1 Trench Backfill

Backfill trenches to the grade shown.

3.11.1.1 Replacement of Unyielding Material

Replace unyielding material removed from the bottom of the trench with select granular material or initial backfill material.

3.11.1.2 Replacement of Unstable Material

Replace unstable material removed from the bottom of the trench or excavation with select granular material placed in layers not exceeding 6 inches loose thickness.

3.11.1.3 Bedding and Initial Backfill

Place initial backfill material and compact it with approved tampers to a height of at least one foot above the utility pipe or conduit. Bring up the backfill evenly on both sides of the pipe for the full length of the pipe. Take care to ensure thorough compaction of the fill under the haunches of the pipe. Compact backfill to top of pipe to 95 percent of ASTM D698 maximum density. Provide plastic piping with bedding to spring line of pipe. Provide materials as follows:

3.11.1.3.1 Class I

Angular, 0.25 to 1.5 inch, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

3.11.1.3.2 Class II

Coarse sands and gravels with maximum particle size of 1.5 inch, including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.

3.11.1.4 Final Backfill

Fill the remainder of the trench, except for special materials for roadways, railroads and airfields, with satisfactory material. Place backfill material and compact as follows:

3.11.1.4.1 Roadways, Railroads, and Airfields

Place backfill up to the required elevation as specified. Do not permit water flooding or jetting methods of compaction.

3.11.1.4.2 Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas

Deposit backfill in layers of a maximum of 12 inches loose thickness, and compact it to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Do not permit compaction by water flooding or jetting. Apply this requirement to all other areas not specifically designated above.

3.11.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for 14 days, place backfill in such a manner that the structure is not be damaged by the shock of falling earth. Deposit the backfill material, compact it as specified for final backfill, and bring up the backfill evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.12 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.12.1 Electrical Distribution System

Provide a minimum cover of 24 inches from the finished grade to direct burial cable and conduit or duct line, unless otherwise indicated.

3.13 EMBANKMENTS

3.13.1 Earth Embankments

Construct earth embankments from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 3 inches. Place the material in successive horizontal layers of loose material not more than 8 inches in depth. Spread each layer uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, plow, disk, or otherwise break up each layer; moisten or aerate as necessary; thoroughly mix; and compact to at least 95 percent laboratory maximum density for cohesive materials and 95 percent laboratory maximum density for cohesionless materials. Backfill material must be within the range of -2 to +2 percent of optimum moisture content at the time of compaction.

Compaction requirements for the upper portion of earth embankments forming subgrade for pavements are identical with those requirements specified in paragraph SUBGRADE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.14 SUBGRADE PREPARATION

3.14.1 Proof Rolling

Finish proof rolling on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. Operate the roller in a systematic manner to ensure the number of passes over all areas, and at speeds between 2-1/2

to 3-1/2 mph. When proof rolling, provide one-half of the passes made with the roller in a direction perpendicular to the other passes. Notify the Contracting Officer a minimum of 3 days prior to proof rolling. Perform proof rolling in the presence of the Contracting Officer. Undercut rutting or pumping of material as directed by the Contracting Officer and replace with fill and backfill material.

3.14.2 Construction

Shape subgrade to line, grade, and cross section, and compact as specified. Include plowing, disking, and any moistening or aerating required to obtain specified compaction for this operation. Remove soft or otherwise unsatisfactory material and replace with satisfactory excavated material or other approved material as directed. Excavate rock encountered in the cut section to a depth of 6 inches below finished grade for the subgrade. Bring up low areas resulting from removal of unsatisfactory material or excavation of rock to required grade with satisfactory materials, and shape the entire subgrade to line, grade, and cross section and compact as specified. After rolling, the surface of the subgrade for roadways shall not show deviations greater than 1/2 inch when tested with a 12-foot straightedge applied both parallel and at right angles to the centerline of the area. Do not vary the elevation of the finish subgrade more than 0.05 foot from the established grade and cross section.

3.14.3 Compaction

Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas, compact each layer of the embankment to at least 95 percent of laboratory maximum density.

3.14.3.1 Subgrade for Pavements

Compact subgrade for pavements to at least 95 percentage laboratory maximum density for the depth below the surface of the pavement shown. When more than one soil classification is present in the subgrade, thoroughly blend, reshape, and compact the top 6 inch of subgrade.

3.15 FINISHING

Finish the surface of excavations, embankments, and subgrades to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. Provide the degree of finish for graded areas within 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades specified in paragraph SUBGRADE PREPARATION. Finish gutters and ditches in a manner that will result in effective drainage. Finish the surface of areas to be turfed from settlement or washing to a smoothness suitable for the application of turfing materials. Repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes.

3.15.1 Subgrade and Embankments

During construction, keep embankments and excavations shaped and drained. Maintain ditches and drains along subgrade to drain effectively at all times. Do not disturb the finished subgrade by traffic or other operation. Protect and maintain the finished subgrade in a satisfactory condition until ballast, subbase, base, or pavement is placed. Do not

permit the storage or stockpiling of materials on the finished subgrade. Do not lay subbase, base course, ballast, or pavement until the subgrade has been checked and approved, and in no case place subbase, base, surfacing, pavement, or ballast on a muddy, spongy, or frozen subgrade.

3.15.2 Grading Around Structures

Construct areas within 5 feet outside of each structure line true-to-grade, shape to drain, and maintain free of trash and debris until final inspection has been completed and the work has been accepted.

3.16 PLACING TOPSOIL

On areas to receive topsoil, prepare the compacted subgrade soil to a 3 inches depth for bonding of topsoil with subsoil. Spread topsoil evenly to a thickness of 3 inches and grade to the elevations and slopes shown. Do not spread topsoil when frozen or excessively wet or dry. Obtain material required for topsoil in excess of that produced by excavation within the grading limits from offsite areas.

3.17 TESTING

Perform testing by a Corps validated commercial testing laboratory or the Contractor's testing facility. Submit qualifications of the Corps validated commercial testing laboratory or the qualifications of the Contractor's testing facilities. If the Contractor elects to establish testing facilities, do not permit work requiring testing until the Contractor's facilities have been inspected, Corps validated and approved by the Contracting Officer.

a. Determine field in-place density in accordance with ASTM D1556/D1556M or ASTM D6938. When ASTM D6938 is used, check the calibration curves and adjust using only the sand cone method as described in ASTM D1556/D1556M. ASTM D6938 results in a wet unit weight of soil in determining the moisture content of the soil when using this method.

b. Check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D6938; check the calibration of both the density and moisture gauges at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, remove the material, replace and recompact to meet specification requirements.

c. Perform tests on recompacted areas to determine conformance with specification requirements. Appoint a registered professional civil engineer to certify inspections and test results. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.17.1 Fill and Backfill Material Gradation

One test per 100 cubic yards stockpiled or in-place source material. Determine gradation of fill and backfill material in accordance with ASTM C136/C136M or ASTM D1140.

3.17.2 In-Place Densities

a. One test per 25 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.

b. One test per 250 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.

c. One test per 100 linear feet, or fraction thereof, of each lift of embankment or backfill for roads.

3.17.3 Check Tests on In-Place Densities

If ASTM D6938 is used, check in-place densities by ASTM D1556/D1556M as follows:

a. One check test per lift for each 2500 square feet, or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.

b. One check test per lift for each 250 square feet, of fill or backfill areas compacted by hand-operated machines.

c. One check test per lift for each 100 linear feet, or fraction thereof, of embankment or backfill for roads.

3.17.4 Moisture Contents

In the stockpile, excavation, or borrow areas, perform a minimum of two tests per day per type of material or source of material being placed during stable weather conditions. During unstable weather, perform tests as dictated by local conditions and approved by the Contracting Officer.

3.17.5 Optimum Moisture and Laboratory Maximum Density

Perform tests for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 500 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.17.6 Tolerance Tests for Subgrades

Perform continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION during construction of the subgrades.

3.18 DISPOSITION OF SURPLUS MATERIAL

Remove surplus material or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber from Government property and delivered to a licensed/permitted facility or to a location approved by the Contracting Officer.

3.19 TUNNEL EXCAVATION AND BACKFILL

Where tunnels are uncovered during excavation activities by the Contractor within the limits of the project, the Contractor shall immediately notify the Border Patrol and Contracting Officer. Once the Border Patrol and

Contractor have been notified of discovery of a tunnel, the Contractor shall be required to wait for clearance from the Contracting Officer to proceed with the excavation. Such notification of clearance to proceed must be in writing. All tunnels discovered and the subsequent excavation/over excavation are to be identified in the as-built drawings and referenced by their either stationing and offset from the centerline or by latitude/longitude. The Contractor shall excavate to expose the entire limits of the tunnel(s). In addition, the Contractor shall over excavate so that the total depth of the excavation is 6 inches below the bottom of the tunnel(s) and the total length of the excavation is 12 inches on each side of the outer horizontal limits of the tunnel(s). The total width of the excavation shall be 18 inches minimum. The Contractor shall build an earthen bulkhead to block the tunnel and continue the bollard fence construction.

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SECTION 31 11 00

CLEARING AND GRUBBING
08/08

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. DEPARTMENT OF DEFENSE (DOD)

DODI 4150.07	(2008; Change 1-2017) DOD Pest Management Program

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are forinformation only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Herbicide Application Plan

SD-03 Product Data

Nonsaleable Materials

Herbicides

SD-04 Samples

Tree Wound Paint

SD-07 Certificates

Qualifications

SD-11 Closeout Submittals

Pest Management Report

1.3 QUALITY CONTROL

1.3.1 Regulatory Requirements

Comply with DODI 4150.07 for requirements on Contractor's licensing, certification, and record keeping. Maintain daily records using the Pest Management Maintenance Record, DD Form 1532-1, or a computer generated equivalent. These forms may be obtained from the main web site: http://www.dtic.mil/whs/directives/forms/eforms/dd1532-1.pdf

1.3.2 Qualifications

For the application of herbicides, use the services of an applicator who is commercially certified in the state where the work is to be performed as required by DODI 4150.07. Submit a copy of the pesticide applicator certificates.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site, and handle in a manner which will maintain the materials in their original manufactured or fabricated condition until ready for use.

1.4.1 Storage

Storage of herbicides on the projects(s)shall be located in areas approved by the local Environmental jurisdiction and the Contracting Officer.

1.4.2 Handling

Handle herbicides in accordance with the manufacturer's label and Safety Data Sheet (SDS), preventing contamination by dirt, water, and organic material. Protect herbicides from weather elements as recommended by the manufacturer's label and SDS. Spill kits must be maintained on herbicide control vehicles. Mixing of herbicides on the installation will not be permited unless it is written into the contract.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Tree Wound Paint

Submit samples in cans with manufacturer's label of bituminous based paint of standard manufacture specially formulated for tree wounds.

2.1.2 Herbicide

Provide herbicides currently registered by the EPA or approved for such use by the appropriate agency of the host county and approved by the Contracting Officer. Select a herbicide that is suitable for the climatic conditions at the project site. Submit manufacturer's label and SDS for herbicides proposed for use.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Herbicide Application Plan

Prior to commencing application of herbicide, submit a herbicide application plan with proposed sequence of treatment work including dates and times of application. Include the herbicide trade name, EPA registration number, chemical composition, formulation, application rate of active ingredients, method of application, area or volume treated, and amount applied. Include a copy of the pesticide applicator certificates.

3.1.2 Protection

3.1.2.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.2.2 Trees, Shrubs, and Existing Facilities

Provide protection in accordance with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

3.1.2.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing utility line. The Contractor is responsible for the repair of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, notify the Contracting Officer in ample time to minimize interruption of the service. Refer to Section 01 30 00 ADMINISTRATIVE REQUIREMENTS and Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS for additional utility protection.

3.2 Application

3.2.1 Herbicide Application

Adhere to safety precautions as recommended by the manufacturer concerning handling and application of the herbicide.

3.2.1.1 Clean Up, Disposal, And Protection

Once application has been completed, proceed with clean up and protection of the site without delay. Clean the site of all material associated with the treatment measures, according to label instructions, and as indicated. Remove and dispose of excess and waste material off Government property.

3.2.1.1.1 Disposal of Herbicide

Dispose of residual herbicides and containers off Government property, and in accordance with the approved disposal plan, label instructions and EPA requirements.

3.3 CLEARING

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter and shall be trimmed of all branches the heights indicated or directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts more than 1-1/2

inches in diameter shall be painted with an approved tree-wound paint. Apply herbicide in accordance with the manufacturer's label to the top surface of stumps designated not to be removed.

3.3.1 Tree Removal

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS.

3.3.2 Grubbing

Grubbing consists of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas. Remove material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Fill depressions made by grubbing with suitable material and compact to make the surface conform with the original adjacent surface of the ground.

3.4 DISPOSAL OF MATERIALS

3.4.1 Nonsaleable Materials

Written permission to dispose of such products on private property shall be filed with the Contracting Officer. Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, except for salable timber, shall be disposed of outside the limits of Government-controlled land at the Contractor's responsibility, except when otherwise directed in writing. Such directive will state the conditions covering the disposal of such products and will also state the areas in which they may be placed.

3.5 CLOSEOUT ACTIVITIES

3.5.1 Herbicides

Upon completion of this work, submit the Pest Management Report DD Form 1532, or an equivalent computer product, to the Integrated Pest Management Coordinator. This form identifies the type of operation, brand name and manufacturer of herbicide, formulation, concentration or rate of application used.

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SECTION 31 63 29

DRILLED CONCRETE PIERS AND SHAFTS
11/14

PART 1 GENERAL

.1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 301	(2016) Specifications for Structural Concrete
ACI 304R	(2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	(2010) Guide to Hot Weather Concreting
ACI 306.1	(1990; R 2002) Standard Specification for Cold Weather Concreting
ACI 318	(2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)
ACI 336.1	(2001) Specification for the Construction of Drilled Piers
ACI SP-66	(2004) ACI Detailing Manual

AMERICAN WELDING SOCIETY (AWS)

AWS A5.1/A5.1M	(2012) Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS D1.1/D1.1M	(2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel
AWS D1.4/D1.4M	(2011) Structural Welding Code - Reinforcing Steel

ASTM INTERNATIONAL (ASTM)

ASTM A615/A615M	(2016) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C143/C143M	(2015a) Standard Test Method for Slump of

	Hydraulic-Cement Concrete
ASTM C150/C150M	(2018) Standard Specification for Portland Cement
ASTM C172	(2010) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C31/C31M	(2018a) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C39/C39M	(2018) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94/C94M	(2017a) Standard Specification for Ready-Mixed Concrete

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 10MSP	(2009; 28th Ed; Errata) Manual of Standard Practice

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

FHWA NHI-10-016	(2010) Drilled Shafts: Construction Procedures and LRFD Design Methods

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926.501	Duty to Have Fall Protection
29 CFR 1926.502	Fall Protection Systems Criteria and Practices
29 CFR 1926.651	Specific Excavation Requirements

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01

Installation Plan

SD-02 Shop Drawings

Drilled Shaft Diameters

Depth of Test Holes

Top and Bottom of Shaft Elevations

Steel Reinforcement

Anchor Bolt Locations

Accessories

SD-05 Design Data

Mix Design Data

SD-06 Test Reports

Ground Water Conditions

Penetration Test

Slump

Concrete

Compressive Strength

Soil Boring Log

SD-07 Certificates

Bill of Lading for Ready-Mix Concrete Deliveries

Steel Reinforcement

Welding Certificates

Excavation and Drilling Equipment

Qualifications of Excavator

Qualifications of Engineer

1.3 QUALITY CONTROL

1.3.1 General

Install drilled shaft foundations in accordance with applicable requirements as described by ACI 336.1, and FHWA NHI-10-016

1.3.2 Sequencing and Scheduling

Submit a detailed installation plan describing the schedule for drilling and/or excavation, installation of steel reinforcement and concrete placement with anticipated site conditions so that each excavated shaft is poured the same day that the drilling is performed.

1.3.3 Inspection Criteria

Inspection activities should be designed to minimize delays while insuring the intent of the Industry Standard Specifications.

1.3.4 Qualification of Excavation Contractor

An experienced excavator with five (5) years experience and licensed in the State of Texas, specialized in excavating and installing work similar in material, design, and extent to that indicated for this Project. Submit

certificates substantiating the Qualifications of Excavator.

1.3.5 Qualification of Professional Engineer

Provide engineering services by an authorized engineer currently licensed in the State of Texas; having a minimum of four (4) years experience as an engineer knowledgeable in drilled shaft foundation design analysis, protocols and procedures for the ACI 336.1, FHWA NHI-10-016, and the Texas Building Code. Submit certificates substantiating the Qualifications of Engineer.

1.3.6 Welding Qualifications

Provide and maintain qualified procedures and personnel according to AWS D1.1/D1.1M, AWS D1.4/D1.4M, and AWS A5.1/A5.1M. Submit Welding Certificates to the Contracting Officer. See Section 05 12 00 STRUCTURAL STEEL for complete requirements

1.3.7 Pre-Construction Conference

After submittals are received and approved but before drilled shaft excavation and foundation work, including associated work, is performed, the Contracting Officer will hold a pre-construction conference to review the following:

a. The drawings, specifications and the geotechnical report.

b. Finalize construction schedule and verify availability of materials, Excavator's personnel, equipment, and facilities needed to make progress and avoid delays.

c. Methods and procedures related to drilled shaft foundation installation, including engineer's written instructions.

d. Support conditions for compliance with requirements, including alignment between foundation system and erection of structural members.

e. Governing regulations and requirements for, certificates, insurance, tests and inspections if applicable.

f. Temporary protection requirements for foundation assembly during and after installation.

1.4 PROJECT CONDITIONS

1.4.1 Existing Conditions

Locate existing underground utilities before excavating drilled shaft foundations. If existing utilities are to remain in place, provide protection during drilled shaft operations.

1.4.2 Interruption of Existing Utilities

Do not interrupt any utility to occupied facilities unless directed in writing by the Contracting Officer.

1.4.3 Weather Limitations

Proceed with installation preparation only when existing and forecasted

weather conditions permit work to proceed without water entering into the area of excavation.

PART 2 PRODUCTS

2.1 DESIGN REQUIREMENTS

Submit design data for the following:

a. Mix design data in accordance with paragraph READY-MIX CONCRETE accompanied by the Bill of Lading for Ready Mix Concrete deliveries.

2.1.1 Assembly

Installation drawings are to include, but not limited to, the following items indicating a completely dimensioned layout and location of drilled shafts and concrete placement for foundation system. Submit detailed shop drawings for the following:

a. Drilled shaft diameters

b. Depth of test holes

c. Top and bottom of shaft elevations

d. Steel reinforcement

e. Anchor bolt locations

f. Accessories

2.2 EQUIPMENT

2.2.1 Drilling and Excavation Equipment

Provide drilling and excavation equipment having adequate capacity, including but not limited to, power, torque and down thrust to excavate a hole of diameter and depth indicated. Also provide excavation and over-reaming tools of adequate design, size and strength to perform the work indicated.

Provide special drilling equipment including, but not limited to, rock core barrels, rock tools, air tools and other equipment as necessary to construct the shaft excavation to the size and depth indicated when materials encountered can not be drilled using earth augers and/or over-reaming tools.

Submit certificates substantiating appropriate selection of excavation and drilling equipment.

2.3 MATERIALS

2.3.1 Steel Reinforcement

2.3.1.1 Deformed Steel Bars

Steel bars conforming to ASTM A615/A615M, Grade 60 ksi and ACI 318.

2.3.2 Ready-Mix Concrete

Ready-Mix concrete and mix design conforming to ACI 117, ACI 301, and ACI 304R, minimum compressive strength 4000 psi at 28 days. Slump results between 5 to 6 inches, according to ASTM C143/C143M.

Portland cements conforming to ASTM C150/C150M, Type II. Provide one brand and type of cement for formed concrete having exposed-to-view finished surfaces.

Potable water conforming to ASTM C94/C94M.

Measure, batch, mix and deliver concrete according to ASTM C94/C94M and furnish batch ticket information.

PART 3 EXECUTION

3.1 PREPARATION

Protect existing structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled shaft foundation operations.

Provide Fall Protection as required by 29 CFR 1926.501, 29 CFR 1926.502 and 29 CFR 1926.651.

3.2 INSTALLATION

3.2.1 Construction Criteria

Provide equipment for checking the dimensions and alignment of each shaft excavation. Determine dimensions and alignment jointly with the contractor and engineer. Measure final shaft depths with appropriate weighted tape measure or other approved method after cleaning.

Provide and install monolithically cast-in-place concrete drilled shaft foundation to the sizes indicated.

Provide and install straight cylindrical shaft foundation of the type indicated.

Tolerances:

a. Maximum variation of the center of any shaft foundation from the required location: 3 inches, measured at the ground surface.

b. Bottom Diameter: Minus zero, plus 6 inches, measured in any direction.

c. Maximum variation from plumb: 1:40.

d. Maximum bottom level: Plus or minus 2 inches.

3.2.2 Excavation

Accomplish excavation of shaft foundations by standard excavation methods including, but not limited to, conventional augers fitted with soil and/or rock teeth, or under-reaming tools attached to drilling equipment of adequate size, power, torque and down thrust necessary for the work.

Perform excavation through whatever materials that are encountered to the dimensions, depths and applicable ACI 336.1 tolerances.

Protect excavated walls with temporary watertight steel casings of sufficient length to prevent water intrusion, cave-ins, displacement of surrounding earth, and injury to personnel and damage to construction operations.

Excavate shafts for drilled foundations to indicated elevations. Remove loose debris, materials and/or muck to make bottom surfaces level within ACI 336.1 tolerances.

Remove water from excavated shaft prior to concrete placement.

3.2.3 Steel Reinforcement

Comply with recommendations in the CRSI "Manual of Standard Practice" CRSI 10MSP for fabricating, placing and supporting reinforcement. Shop fabricate steel reinforcement in accordance with ACI SP-66.

When practicable to deliver the reinforcement cage assembly to the jobsite as a complete unit ready for installation, should it not be possible make remaining connections and/or splices, as indicated on the approved shop drawings, at-grade level prior to lowering the complete assembly into the hole.

Clean reinforcement of loose rust, mill scale, earth and other foreign materials. Do not tack weld crossing reinforcing bars. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

Lower reinforcement steel into the hole in such a manner as to prevent damage to the walls of the excavation. Place, tie and/or clip cage symmetrically about the axis of the shaft. Use centering devices securely attached to the cage to clear the shaft walls and maintain the cage in place throughout the concrete placement operations.

Cooperate with other trades in setting of anchor bolts, inserts, and other embedded items. Where conflicts occur between reinforcing and embedded items, notify the Contracting Officer so that conflicts may be reconciled before concrete placement. Position and support anchors and embedded items with appropriate accessories.

Use templates to set anchor bolts, leveling plates and other accessories required for structure erection. Provide blocking and/or holding devices to maintain required anchoring positions during final concrete placement.

3.2.4 Concrete Placement

Keep all equipment, including but not limited to, mixers, pumps, hoses, tools and screeds clean and free of set concrete throughout the placement operation.

Convey concrete from the mixer to place of deposit by best industry methods that prevents segregation and loss of material. Size and design the equipment for conveying concrete to ensure uniform, continuous placement of concrete. Concrete shall not be allowed to free fall a height greater than 3 feet.

Place concrete in accordance with ACI 318.

Place concrete in a continuous operation and without segregation into dry excavations whenever possible after inspection and written approval by the Contracting Officer. Use all practicable means to obtain a dry excavation before and during concrete placement. When the contractor has elected to utilize casings in the drilled shaft for the prevention of water intrusion, cave-ins and displacement of surrounding earth, these casings shall be carefully removed during placement of the concrete in the shaft, maintaining the bottom of the casing 3 feet below the top of the concrete being placed. Care shall be taken during the extraction of the casing to not displace the concrete nor reinforcement.

Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. When hot weather conditions exist that would impair quality and strength of placed concrete, comply with ACI 305R. Comply with ACI 306.1 for cold-weather protection.

A minimum of 50 percent of the base for each shaft is to be less than 1/2 inch of sediment at the time of concrete placement. Maximum depth of sediment or debris at any place on the base of the shaft is not to exceed 1-1/2 inches. Shaft cleanliness is to be determined by the engineer by visual inspection.

3.3 FIELD QUALITY CONTROL

3.3.1 Test Reports

As a minimum, submit the following test reports and data.

a. Ground Water conditions

b. Penetration Test

c. Slump

d. Concrete

e. Compressive Strength

Sample and test concrete for quality control during placement. Quality control testing is provided by the contract.

Sample freshly placed concrete for testing in accordance with ASTM C172.

Make concrete test specimens for compressive strength at 7 and 28 days for each design mix conforming to ASTM C31/C31M. Compression test concrete in accordance with ASTM C39/C39M.

Test Slump at plant for each design mix in accordance with ASTM C143/C143M.

3.3.2 Boring Logs

As a minimum, submit the following data:

a. Soil Boring Log

A boring log based on drilled auger cuttings will be provided to jointly check subsurface material from the surface to the bottom of the drilled pier with the contractor prior to placement ensure the materials

encountered are similar to the design geotechnical borings.

-- End of Section --

SECTION 32 11 24

GRADED CRUSHED AGGREGATE BASE COURSE FOR PERVIOUS PAVEMENT
11/11

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C117	(2017) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131/C131M	(2014) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2014) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D1556/D1556M	(2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D1883	(2016) Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils
ASTM D2217	(1985; R 1998) Wet Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants
ASTM D4318	(2017) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D6938	(2017) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D75/D75M	(2014) Standard Practice for Sampling Aggregates

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Aggregates

SD-06 Test Reports

Gradation

Bearing ratio

Liquid limit

Plasticity index

Percentage of wear

Smoothness

Density

1.3 DELIVERY AND STORAGE

Inspect materials delivered to site for damage and store as to prevent segregation and contamination.

1.4 WEATHER LIMITATIONS

Do not construct base course when atmospheric temperature is below 35 degrees F or when rainfall or other weather conditions detrimentally affect the quality of the finished course.

1.5 CONSTRUCTION EQUIPMENT

Equipment shall be dependable and adequate for the purpose intended. Maintain equipment in satisfactory and safe operating condition. Subject to approval, special equipment dictated by local conditions may be used. Calibrated equipment, such as scales, batching equipment, spreaders, and similar items, shall have been recalibrated by a State calibration laboratory within 12 months of commencing work.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aggregates

Consist of durable and sound crushed concrete, crushed masonry, crushed tile, crushed gravel, crushed stone, or crushed slag, free of lumps or balls of clay or other objectionable matter. Crushed stone and gravel shall be free from flat, elongated, soft, or disintegrated pieces. Crushed gravel retained on a No. 4 sieve shall have at least 90 percent by weight

with at least two fractured faces and 100 percent by weight with at least one fractured face. Base course materials samples shall have a bearing ratio of at least 100 as determined by laboratory tests on a 4-day soaked specimen in accordance with ASTM D1883; compact specimen in accordance with ASTM D1557, Method D. Determine grain size in accordance with ASTM C136/C136M and amount of material finer than 200 mesh sieve in accordance with ASTM C117. Aggregate, other than slag, shall have a percentage of wear not exceeding 40 when tested in accordance with ASTM C131/C131M, Grading A. Soil binder material, that portion of material passing the No. 40 sieve, shall be of such composition that the composite material conforms to the requirements specified herein. The base course shall be of such nature that it can be compacted readily with watering and rolling to a firm, stable base and shall conform to one of the following sizes:

Percentage by Weight Passing Square Mesh Laboratory Sieves			
Sieves	Size Numbers		
	1	2	3
50.0 mm 2 inch	100	-	-
37.5 mm 1 1/2 inch	70-100	100	-
25.0 mm 1 inch	45-80	60-100	100
12.5 mm 1/2 inch	30-60	30-65	40-70
4.75 mm No. 4	20-50	20-50	20-50
2.0 mm No. 10	15-40	15-40	15-40
425 micrometers No. 40	5-25	5-25	5-25
75 micrometers No. 200	0-10	0-10	0-10

That portion of the material passing the No. 40sieve shall have a liquid limit of not more than 25 and a plasticity index of not more than 5 as determined by ASTM D4318. Prepare samples in accordance with ASTM D2217, Procedure A.

PART 3 EXECUTION

3.1 BASE COURSE

Construct the graded aggregate base course on a prepared subgrade as indicated. Verify compacted subgrade, granular base, or stabilized soil is acceptable and ready to support paving and imposed loads. Provide line and grade stakes for control. Place grade stakes in lanes parallel to the centerline of areas to be paved and space for string lining or other control methods. The base course shall consist of aggregate processed, deposited, spread, and compacted on a prepared surface. The Contractor shall be responsible for protection of completed areas against detrimental effects. Recondition, reshape, and recompact areas damaged by freezing, rainfall, or other weather conditions.

3.2 MIXING OF MATERIALS

Mix aggregates in a stationary or traveling plant. Proportion aggregates by weight or volume in such quantities that specified gradation, liquid limit, and plasticity index requirements are met after the base course has been placed and compacted. Incorporate, during the mixing operation, water in quantities sufficient to provide the necessary moisture content for the specified compaction. Mixing operations shall produce satisfactory uniform blending and the method of discharging into trucks shall not produce segregation.

3.3 PLACING

Do not dump mixed materials in piles, but place on prepared subgrade or subbase in layers of uniform thickness with a spreader. When a compacted course 6 inches in thickness is required, place material in a single layer. When a compacted course in excess of 6 inches is required, place material in layers of equal thickness. Do not exceed 6 inches or have less than 3 inches in thickness for any compacted layer. Place layers so that when compacted, they will be true to grades or levels required with the least possible surface disturbance. Where the base course is constructed in more than one layer, clean previously constructed layers of loose and foreign matter. Maintain material water content during the placing period to obtain the compaction specified. Make adjustments in placing procedures or equipment to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to insure a satisfactory base course.

3.3.1 Stationary-Plant Method

Mix aggregates, binder material and water until a uniform homogeneous mixture is obtained. Do not dump materials in piles; place in layers of essentially uniform thickness, not to exceed 6 inches after compaction, by an approved spreader. Tail gate spreading will be acceptable only with permission, under conditions such as where space limitations prohibit use of the spreader.

3.3.2 Windrow Traveling-Plant Method

Place aggregates and binder materials in windrows of such cross section and proportions that, when picked up, mixed, and redeposited in windrows, the finished mixture shall conform to the specified requirements. Do not exceed the rated capacity of the traveling plant with the size of the windrow of the combined materials. Add water, in quantity sufficient to provide the necessary moisture content for compacting, to the aggregates at the time of mixing. Mix materials uniformly by the traveling plant, deposit in windrows of uniform cross section, and spread in a layer of uniform thickness to the required contour and grades.

3.4 COMPACTING AND FINISHING

Immediately following the placing, spread the finished mixture uniformly in a layer and bring to optimum moisture content. The loose thickness and the surface of the layer shall be such that the specified density and the required thickness shall be obtained after compaction. Compact the layer with steel-faced, vibrating or pneumatic-tired rollers, or other suitable compacting equipment or combinations thereof. Continue compacting until the layer is compacted through the full depth to a field density of at least 100 percent of the maximum density at optimum moisture content tested

in accordance with ASTM D6938. In areas not accessible to rollers or compactors, compact the mixture with mechanical hand tampers. If the mixture is excessively moistened by rain, aerate by blade graders, or other suitable equipment. Aerate until the moisture content of the material is that needed to obtain the required density. Finish the surface of the layer by a combination of rolling and blading. Final surface shall be smooth and free from waves, irregularities, and ruts or soft yielding spots.

3.5 PROOF ROLLING

Proof roll the top surface of the completed base course by making eight coverages with a heavy rubber-tired roller having four tires with each tire loaded to 30,000 pounds or more and inflated to at least 150 psi. Make four coverages over other areas to be paved, excluding the runway over-runs, blast protection areas, and shoulders. A coverage is defined as one application of one tire print over each point in the surface of the designated area. When under the action of the proof rolling, the base course yields, pumps, or otherwise fails, remove, replace with suitable materials, and recompact materials in the base course or in the underlying layers indicated to be unsatisfactory. The speed of the roller shall not exceed 5 miles per hour. Obtain approval upon completion of the proof rolling of the base course.

3.6 FINISHING AT EDGES OF BASE COURSE

Place earth or other approved materials along the edges of the base course in such quantity that it will compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, place material to the thickness of each layer. In each operation, allow at least a one foot width of the shoulder to be rolled and compacted simultaneously with the rolling and compacting of each layer.

3.7 FIELD QUALITY CONTROL

Approve materials and material sources in advance of the use of such materials in the work. Replace base where samples are removed.

3.7.1 Sampling

3.7.1.1 Aggregates at the Source

Prior to production and delivery of aggregates, take at least one initial sample in accordance with ASTM D75/D75M. Collect each sample by taking three incremental samples at random from the source material to make a composite sample of not less than 50 pounds. Repeat above sampling when source of material is changed or when unacceptable deficiencies or variations from specified grading of materials are found in testing.

3.7.1.2 During Construction

Take one random sample from each 50 tons of completed course material, but not less than one random sample per day's run. Take samples in accordance with ASTM D75/D75M.

3.7.1.3 Sample Identification

Place each sample in a clean container, securely fastened to prevent loss of material. Tag each sample for identification and with the following information:

Contract No.____
Sample No.______________________ Quality ___________
Date of Sample______________________________________
Sampler____
Source____
Intended Use____
For Testing____

3.7.2 Testing

3.7.2.1 Aggregates

Test each sample of base course material without delay. Make gradation tests from each sample in accordance with ASTM C136/C136M. Make sieve analysis on material passing the No. 200 sieve in accordance with ASTM C117.

3.7.2.2 Smoothness Tests

Test with a 10 foot straightedge, applied parallel with and at right angles to the center line of the paved area. Correct deviations in the surface in excess of 1/2 inch by loosening, adding or removing material, reshaping, watering, and compacting. The smoothness requirements specified herein apply only to the top layer when base course is constructed in more than one layer.

3.7.2.3 Field Density Tests

ASTM D1556/D1556M or ASTM D6938. Take one test for each 100 square yards of each layer of base course or each day's placement.

3.7.2.4 Laboratory Density Tests

In accordance with ASTM D1557, Method D.

3.8 MAINTENANCE

After construction is completed, maintain the base course throughout, except where portion of the succeeding course is under construction thereon. Maintenance includes drainage, rolling, shaping, and watering, as necessary, to maintain the course in proper condition. Correct deficiencies in thickness, composition, construction, smoothness, and density, which develop during the maintenance, to conform to the requirements specified herein. Maintain sufficient moisture by light sprinkling with water at the surface to prevent a dusty condition.

-- End of Section --

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SECTION 32 12 16

HOT-MIX ASPHALT (HMA) FOR ROADS
08/09

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 156	(2013; R 2017) Standard Specification for Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
AASHTO M 320	(2017) Standard Specification for Performance-Graded Asphalt Binder
AASHTO T 304	(2011; R 2015) Standard Method of Test for Uncompacted Void Content of Fine Aggregate

ASPHALT INSTITUTE (AI)

AI MS-2	(2015) Asphalt Mix Design Methods
AI SP-2	(2001; 3rd Ed) Superpave Mix Design

ASTM INTERNATIONAL (ASTM)

ASTM C117	(2017) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C127	(2015) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C128	(2015) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM C131/C131M	(2014) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2014) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C142/C142M	(2017) Standard Test Method for Clay Lumps and Friable Particles in Aggregates

ASTM C29/C29M	(2017a) Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C566	(2013) Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
ASTM D140/D140M	(2016) Standard Practice for Sampling Asphalt Materials
ASTM D1461	(2017) Standard Test Method for Moisture or Volatile Distillates in Asphalt Mixtures
ASTM D2172/D2172M	(2017) Standard Test Methods for Quantitative Extraction of Asphalt Binder from Asphalt Mixtures
ASTM D2419	(2014) Sand Equivalent Value of Soils and Fine Aggregate
ASTM D242/D242M	(2009; R 2014) Mineral Filler for Bituminous Paving Mixtures
ASTM D2489/D2489M	(2016) Standard Test Method for Estimating Degree of Particle Coating of Asphalt Mixtures
ASTM D2950/D2950M	(2014) Density of Bituminous Concrete in Place by Nuclear Methods
ASTM D3666	(2016) Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D4125/D4125M	(2010) Asphalt Content of Bituminous Mixtures by the Nuclear Method
ASTM D4791	(2010) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D4867/D4867M	(2009; R 2014) Effect of Moisture on Asphalt Concrete Paving Mixtures
ASTM D5444	(2015) Mechanical Size Analysis of Extracted Aggregate
ASTM D6307	(2016) Standard Test Method for Asphalt Content of Hot Mix Asphalt by Ignition Method
ASTM D6925	(2014) Standard Test Method for Preparation and Determination of the Relative Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor

ASTM D6926	(2016) Standard Practice for Preparation of Asphalt Mixture Specimens Using Marshall Apparatus
ASTM D6927	(2015) Standard Test Method for Marshall Stability and Flow of Bituminous Mixtures

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION (CALTRANS)

CTM 526	(2012) Method of Test for Operation of California Profilograph and Evaluation of Profiles

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 171	(1995) Standard Test Method for Determining Percentage of Crushed Particles in Aggregate

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Mix Design

Quality Control

Material Acceptance

SD-04 Samples

Asphalt Cement Binder

Aggregates

SD-06 Test Reports

Aggregates

QC Monitoring

SD-07 Certificates

Asphalt Cement Binder

Testing Laboratory

1.3 ENVIRONMENTAL REQUIREMENTS

Do not place the hot-mix asphalt upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 3. The temperature requirements may be waived by the Contracting Officer, if requested; however, meet all other requirements, including compaction.

Table 3. Surface Temperature Limitations of Underlying Course	
Mat Thickness, mm inches	Degrees C F
75 3 or greater	4 40
Less than 75 3	7 45

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Perform the work consisting of pavement courses composed of mineral aggregate and asphalt material heated and mixed in a central mixing plant and placed on a prepared course. HMA designed and constructed in accordance with this section shall conform to the lines, grades, thicknesses, and typical cross sections indicated. Construct each course to the depth, section, or elevation required by the drawings and roll, finish, and approve it before the placement of the next course.

2.1.1 Asphalt Mixing Plant

Plants used for the preparation of hot-mix asphalt shall conform to the requirements of AASHTO M 156 with the following changes:

2.1.1.1 Truck Scales

Weigh the asphalt mixture on approved, certified scales at the Contractor's expense. Inspect and seal scales at least annually by an approved calibration laboratory.

2.1.1.2 Testing Facilities

Provide laboratory facilities at the plant for the use of the Government's acceptance testing and the Contractor's quality control testing.

2.1.1.3 Inspection of Plant

Provide the Contracting Officer with access at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant; verifying weights, proportions, and material properties; checking the temperatures maintained in the preparation of the mixtures and for taking samples. Provide assistance as requested, for the Government to procure any desired samples.

2.1.1.4 Storage bins

Use of storage bins for temporary storage of hot-mix asphalt will be permitted as follows:

a. The asphalt mixture may be stored in non-insulated storage bins for a period of time not exceeding 3 hours.

b. The asphalt mixture may be stored in insulated storage bins for a period of time not exceeding 8 hours. The mix drawn from bins shall meet the same requirements as mix loaded directly into trucks.

2.1.2 Hauling Equipment

Provide trucks for hauling hot-mix asphalt having tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material. Petroleum based products shall not be used as a release agent. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers (tarps) shall be securely fastened.

2.1.3 Asphalt Pavers

Provide asphalt pavers which are self-propelled, with an activated screed, heated as necessary, and capable of spreading and finishing courses of hot-mix asphalt which will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.

2.1.3.1 Receiving Hopper

Provide paver with a receiving hopper of sufficient capacity to permit a uniform spreading operation and equipped with a distribution system to place the mixture uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

2.1.4 Rollers

Rollers shall be in good condition and shall be operated at slow speeds to avoid displacement of the asphalt mixture. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. Do not use equipment which causes excessive crushing of the aggregate.

2.2 AGGREGATES

Provide aggregates consisting of crushed stone, crushed gravel, crushed slag, screenings, natural sand and mineral filler, as required. Submit sufficient materials to produce 200 lb of blended mixture for mix design verification. The portion of material retained on the No. 4 sieve is coarse aggregate. The portion of material passing the No. 4 sieve and retained on the No. 200 sieve is fine aggregate. The portion passing the No. 200 sieve is defined as mineral filler. Submit all aggregate test results and samples to the Contracting Officer at least 14 days prior to start of construction.

2.2.1 Coarse Aggregate

Provide coarse aggregate consisting of sound, tough, durable particles, free from films of material that would prevent thorough coating and bonding with the asphalt material and free from organic matter and other deleterious substances. All individual coarse aggregate sources shall meet the following requirements:

a. The percentage of loss shall not be greater than 40 percent after 500 revolutions when tested in accordance with ASTM C131/C131M.

b. At least 75 percent by weight of coarse aggregate shall have at least two or more fractured faces when tested in accordance with COE CRD-C 171. Fractured faces shall be produced by crushing.

c. The particle shape shall be essentially cubical and the aggregate shall not contain more than 20 percent percent, by weight, of flat and elongated particles (3:1 ratio of maximum to minimum) when tested in accordance with ASTM D4791.

d. Slag shall be air-cooled, blast furnace slag, with a compacted weight of not less than 75 lb/cu ft when tested in accordance with ASTM C29/C29M.

e. Clay lumps and friable particles shall not exceed 0.3 percent, by weight, when tested in accordance with ASTM C142/C142M.

2.2.2 Fine Aggregate

Fine aggregate shall consist of clean, sound, tough, durable particles free from coatings of clay, silt, or any objectionable material and containing no clay balls.

a. All individual fine aggregate sources shall have a sand equivalent value not less than 45 when tested in accordance with ASTM D2419.

b. The fine aggregate portion of the blended aggregate shall have an uncompacted void content not less than 45.0 percent when tested in accordance with AASHTO T 304 Method A.

c. The quantity of natural sand (noncrushed material) added to the aggregate blend shall not exceed 25 percent by weight of total aggregate.

d. Clay lumps and friable particles shall not exceed 0.3 percent, by weight, when tested in accordance with ASTM C142/C142M

2.2.3 Mineral Filler

Mineral filler shall be nonplastic material meeting the requirements of ASTM D242/D242M.

2.2.4 Aggregate Gradation

The combined aggregate gradation shall conform to gradations specified in Table 4, when tested in accordance with ASTM C136/C136M and ASTM C117, and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa, but grade uniformly from coarse to fine.

Table 4. Aggregate Gradations

Sieve Size, mm inch	Gradation 2 Percent Passing by Mass
25.0 1	---

Table 4. Aggregate Gradations	
Sieve Size, mm inch	Gradation 2 Percent Passing by Mass
19.0 3/4	100
12.5 1/2	76-96
9.5 3/8	69-89
4.75 No. 4	53-73
2.36 No. 8	38-60
1.18 No. 16	26-48
0.60 No. 30	18-38
0.30 No. 50	11-27
0.15 No. 100	6-18
0.075No. 200	3-6

2.3 ASPHALT CEMENT BINDER

Submit a 5 gallon sample for mix design verification. Asphalt cement binder shall conform to AASHTO M 320 Performance Grade (PG) 75. Test data indicating grade certification shall be provided by the supplier at the time of delivery of each load to the mix plant. Submit copies of these certifications to the Contracting Officer. The supplier is defined as the last source of any modification to the binder. The Contracting Officer may sample and test the binder at the mix plant at any time before or during mix production. Obtain samples for this verification testing in accordance with ASTM D140/D140M and in the presence of the Contracting Officer. Furnish these samples to the Contracting Officer for the verification testing, which shall be at no cost to the Contractor. Submit samples of the asphalt cement specified for approval not less than 14 days before start of the test section. Submit copies of certified test data, amount, type and description of any modifiers blended into the asphalt cement binder.

2.4 MIX DESIGN

a. Develop the mix design. The asphalt mix shall be composed of a mixture of well-graded aggregate, mineral filler if required, and asphalt material. The aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF). Submit proposed JMF; do not produce hot-mix asphalt for payment until a JMF has been approved. The hot-mix asphalt shall be designed in accordance with Marshall (MS-02), Superpave (SP-2), or Hveem (MS-02) procedures and the criteria shown in Table 5. Use the hand-held hammer to compact the specimens for Marshall mix design. If the Tensile

Strength Ratio (TSR) of the composite mixture, as determined by ASTM D4867/D4867M is less than 75, the aggregates shall be rejected or the asphalt mixture treated with an approved anti-stripping agent. The amount of anti-stripping agent added shall be sufficient to produce a TSR of not less than 75. Provide an antistrip agent, if required, at no additional cost. Sufficient materials to produce 200 pound of blended mixture shall be provided to the Contracting Officer for verification of mix design at least 14 days prior to construction of test section.

b. At the option of the Contractor, a currently used ITEM 344 TxDOT Superpave hot mix may be used in lieu of developing a Marshall hot mix design as described herein. Design the Superpave volumetric mix in accordance with AI SP-2 and ASTM D6925. The nominal maximum aggregate size (NMAS) shall be 1/2 inch. Other DOT hot mix design methods (Hveem, etc.) may be suitable, as determined by the Contracting Officer.

2.4.1 JMF Requirements

Submit in writing the job mix formula for approval at least 14 days prior to the start of the test section including as a minimum:

a. Percent passing each sieve size.

b. Percent of asphalt cement.

c. Percent of each aggregate and mineral filler to be used.

d. Asphalt viscosity grade, penetration grade, or performance grade.

e. Number of blows of hand-held hammer per side of molded specimen.

f. Number of gyrations of Superpave gyratory compactor.

g. Laboratory mixing temperature.

h. Lab compaction temperature.

i. Temperature-viscosity relationship of the asphalt cement.

j. Plot of the combined gradation on the 0.45 power gradation chart, stating the nominal maximum size.

k. Graphical plots of stability, flow, air voids, voids in the mineral aggregate, and unit weight versus asphalt content as shown in AI MS-2.

l. Specific gravity and absorption of each aggregate.

m. Percent natural sand.

n. Percent particles with 2 or more fractured faces (in coarse aggregate).

o. Fine aggregate angularity.

p. Percent flat or elongated particles (in coarse aggregate).

q. Tensile Strength Ratio(TSR).

r. Antistrip agent (if required) and amount.

s. List of all modifiers and amount.

t. Correlation of hand-held hammer with mechanical hammer (NA for Superpave).

Table 5. Mix Design Criteria		
Test Property	50 Blows or Mix Gyrations	75 Blows or Mix Gyrations
Stability, N pounds, minimum (NA for Superpave)	*44501000	*80001800
Flow,0.25 mm 0.01 inch, (NA for Superpave)	8-18	8-16
Air voids, percent	3-5	3-5
Percent Voids in mineral aggregate (VMA),(minimum)		
Gradation 1	13.0	13.0
Gradation 2	14.0	14.3
Gradation 3	15.0	15.0
TSR, minimum percent	75	75
* This is a minimum requirement. The average during construction shall be significantly higher than this number to ensure compliance with the specifications.		
** Calculate VMA in accordance with AI MS-2, based on ASTM C127 and ASTM C128 bulk specific gravity for the aggregate.		

2.4.2 Adjustments to Field JMF

Keep the Laboratory JMF for each mixture in effect until a new formula is approved in writing by the Contracting Officer. Should a change in sources of any materials be made, perform a new laboratory jmf design and a new JMF approved before the new material is used. The Contractor will be allowed to adjust the Laboratory JMF within the limits specified below to optimize mix volumetric properties with the approval of the Contracting Officer. Adjustments to the Laboratory JMF shall be applied to the field (plant) established JMF and limited to those values as shown. Adjustments shall be targeted to produce or nearly produce 4 percent voids total mix (VTM).

TABLE 6. Field (Plant) Established JMF Tolerances	
Sieves, mm	Adjustments (plus or minus), percent
12.5 1/2 inch	3

TABLE 6. Field (Plant) Established JMF Tolerances	
Sieves, mm	Adjustments (plus or minus), percent
4.75 No. 4	3
2.36 No. 8	3
0.075No. 200	1
Binder Content	0.4

If adjustments are needed that exceed these limits, develop a new mix design. Tolerances given above may permit the aggregate grading to be outside the limits shown in Table 4; while not desirable, this is acceptable, except for the No. 200 sieve, which shall remain within the aggregate grading of Table 4.

PART 3 EXECUTION

3.1 PREPARATION OF ASPHALT BINDER MATERIAL

Heat the asphalt cement material avoiding local overheating and providing a continuous supply of the asphalt material to the mixer at a uniform temperature. The temperature of unmodified asphalts shall be no more than 325 degrees F when added to the aggregates. Performance-Graded (PG) asphalts shall be within the temperature range of 25 degrees F when added to the aggregate.

3.2 PREPARATION OF MINERAL AGGREGATE

Heat and dry the aggregate for the mixture prior to mixing. No damage shall occur to the aggregates due to the maximum temperature and rate of heating used. The temperature of the aggregate and mineral filler shall not exceed 350 degrees F when the asphalt cement is added. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

3.3 PREPARATION OF HOT-MIX ASPHALT MIXTURE

The aggregates and the asphalt cement shall be weighed or metered and introduced into the mixer in the amount specified by the JMF. Mix the combined materials until the aggregate obtains a uniform coating of asphalt binder and is thoroughly distributed throughout the mixture. Wet mixing time shall be the shortest time that will produce a satisfactory mixture, but no less than 25 seconds for batch plants. Establish the wet mixing time for all plants based on the procedure for determining the percentage of coated particles described in ASTM D2489/D2489M, for each individual plant and for each type of aggregate used. The wet mixing time will be set to at least achieve 95 percent of coated particles. The moisture content of all hot-mix asphalt upon discharge from the plant shall not exceed 0.5 percent by total weight of mixture as measured by ASTM D1461.

3.4 PREPARATION OF THE UNDERLYING SURFACE

Immediately before placing the hot mix asphalt, clean the underlying course of dust and debris. Apply a tack coat in accordance with the contract

specifications.

3.5 TESTING LABORATORY

Submit certification of compliance and Plant Scale Calibration Certification. Use a laboratory to develop the JMF that meets the requirements of ASTM D3666. The Government will inspect the laboratory equipment and test procedures prior to the start of hot mix operations for conformance to ASTM D3666. The laboratory shall maintain the Corps certification for the duration of the project. A statement signed by the manager of the laboratory stating that it meets these requirements or clearly listing all deficiencies shall be submitted to the Contracting Officer prior to the start of construction. The statement shall contain as a minimum:

a. Qualifications of personnel; laboratory manager, supervising technician, and testing technicians.

b. A listing of equipment to be used in developing the job mix.

c. A copy of the laboratory's quality control system.

d. Evidence of participation in the AASHTO Materials Reference Laboratory (AMRL) program.

3.6 TRANSPORTING AND PLACING

3.6.1 Transporting

Transport the hot-mix asphalt from the mixing plant to the site in clean, tight vehicles. Schedule deliveries so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver. Provide adequate artificial lighting for night placements. Hauling over freshly placed material will not be permitted until the material has been compacted as specified, and allowed to cool to 140 degrees F. To deliver mix to the paver, use a material transfer vehicle operated to produce continuous forward motion of the paver.

3.6.2 Placing

Place and compact the mix at a temperature suitable for obtaining density, surface smoothness, and other specified requirements. Upon arrival, place the mixture to the full width by an asphalt paver; it shall be struck off in a uniform layer of such depth that, when the work is completed, it will have the required thickness and conform to the grade and contour indicated. Regulate the speed of the paver to eliminate pulling and tearing of the asphalt mat. Unless otherwise permitted, placement of the mixture shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope. Place the mixture in consecutive adjacent strips having a minimum width of 10 feet. The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 1 foot; however, the joint in the surface course shall be at the centerline of the pavement. Transverse joints in one course shall be offset by at least 10 feet from transverse joints in the previous course. Transverse joints in adjacent lanes shall be offset a minimum of 10 feet. On isolated areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread and luted by hand tools.

3.7 COMPACTION OF MIXTURE

After placing, the mixture shall be thoroughly and uniformly compacted by rolling. Compact the surface as soon as possible without causing displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once. Furnish sufficient rollers to handle the output of the plant. Continue rolling until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained. To prevent adhesion of the mixture to the roller, keep the wheels properly moistened but excessive water will not be permitted. In areas not accessible to the roller, the mixture shall be thoroughly compacted with hand tampers. Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or is in any way defective shall be removed full depth, replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense. Skin patching will not be allowed.

3.8 QUALITY CONTROL

3.8.1 General Quality Control Requirements

Develop and submit an approved Quality Control Plan. Submit aggregate and QC test results. Do not produce hot-mix asphalt for payment until the quality control plan has been approved addressing all elements which affect the quality of the pavement including, but not limited to:

a. Mix Design

b. Aggregate Grading

c. Quality of Materials

d. Stockpile Management

e. Proportioning

f. Mixing and Transportation

g. Mixture Volumetrics

h. Moisture Content of Mixtures

i. Placing and Finishing

j. Compaction

k. Surface Smoothness

3.8.2 Testing Laboratory

Provide a fully equipped asphalt laboratory located at the plant or job site and meeting the pertinent requirements in ASTM D3666. Laboratory facilities shall be kept clean and all equipment maintained in proper working condition. The Contracting Officer shall be permitted unrestricted

access to inspect the Contractor's laboratory facility, to witness quality control activities, and to perform any check testing desired. The Contracting Officer will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to adversely affect test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are corrected.

3.8.3 Quality Control Testing

Perform all quality control tests applicable to these specifications and as set forth in the Quality Control Program. The testing program shall include, but shall not be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, moisture in the asphalt mixture, laboratory air voids, stability, flow (NA for Superpave), in-place density, grade and smoothness. Develop a Quality Control Testing Plan as part of the Quality Control Program.

3.8.3.1 Asphalt Content

A minimum of two tests to determine asphalt content will be performed by one of the following methods: the extraction method in accordance with ASTM D2172/D2172M, Method A or B, the ignition method in accordance with ASTM D6307, or the nuclear method in accordance with ASTM D4125/D4125M. Calibrate the ignition oven or the nuclear gauge for the specific mix being used. For the extraction method, determine the weight of ash, as described in ASTM D2172/D2172M, as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction test performed thereafter, for the duration of plant production. The last weight of ash value obtained shall be used in the calculation of the asphalt content for the mixture.

3.8.3.2 Gradation

Determine aggregate gradations a minimum of twice per lot from mechanical analysis of recovered aggregate in accordance with ASTM D5444. When asphalt content is determined by the ignition oven or nuclear method, aggregate gradation shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix plants. For batch plants, test aggregates in accordance with ASTM C136/C136M using actual batch weights to determine the combined aggregate gradation of the mixture.

3.8.3.3 Temperatures

Check temperatures at least four times per lot, at necessary locations, to determine the temperature at the dryer, the asphalt cement in the storage tank, the asphalt mixture at the plant, and the asphalt mixture at the job site.

3.8.3.4 Aggregate Moisture

Determine the moisture content of aggregate used for production a minimum of once per lot in accordance with ASTM C566.

3.8.3.5 Moisture Content of Mixture

Determine the moisture content of the mixture at least once per lot in accordance with ASTM D1461 or an approved alternate procedure.

3.8.3.6 Laboratory Air Voids, Marshall Stability and Flow

Take mixture samples at least four times per lot compacted into specimens, using 50 blows per side with the hand-held Marshall hammer as described in ASTM D6926. When the Superpave gyratory compactor is used, mixes will be compacted to 50 gyrations in accordance with ASTM D6925. Hot-mix provided under the DOT Superpave option shall be compacted in accordance with the DOT requirements. After compaction, determine the laboratory air voids of each specimen. Stability and flow shall be determined for the Marshall-compacted specimens, in accordance with ASTM D6927.

3.8.3.7 In-Place Density

Conduct any necessary testing to ensure the specified density is achieved. A nuclear gauge may be used to monitor pavement density in accordance with ASTM D2950/D2950M.

3.8.3.8 Grade and Smoothness

Conduct the necessary checks to ensure the grade and smoothness requirements are met.

3.8.3.9 Additional Testing

Any additional testing, which the Contractor deems necessary to control the process, may be performed at the Contractor's option.

3.8.3.10 QC Monitoring

Submit all QC test results to the Contracting Officer on a daily basis as the tests are performed. The Contracting Officer reserves the right to monitor any of the Contractor's quality control testing and to perform duplicate testing as a check to the Contractor's quality control testing.

3.8.4 Sampling

When directed by the Contracting Officer, sample and test any material which appears inconsistent with similar material being produced, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

3.9 MATERIAL ACCEPTANCE

Testing for acceptability of work will be performed by an independent laboratory hired by the Contractor. Forward test results and payment calculations daily to the Contracting Officer. Acceptance of the plant produced mix and in-place requirements will be on a lot to lot basis. A standard lot for all requirements will be equal to 8 hours of production. Where appropriate, adjustment in payment for individual lots of hot-mix asphalt will be made based on in-place density, laboratory air voids, grade and smoothness in accordance with the following paragraphs. Grade and surface smoothness determinations will be made on the lot as a whole. Exceptions or adjustments to this will be made in situations where the mix within one lot is placed as part of both the intermediate and surface courses, thus grade and smoothness measurements for the entire lot cannot be made. In order to evaluate laboratory air voids and in-place (field) density, each lot will be divided into four equal sublots.

3.9.1 Additional Sampling and Testing

The Contracting Officer reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. The cost of any additional testing will be paid for by the Government. Testing in these areas will be in addition to the lot testing, and the requirements for these areas will be the same as those for a lot.

3.9.2 Grade

The final wearing surface of pavement shall conform to the elevations and cross sections shown and shall vary not more than 0.05 foot from the plan grade established and approved at site of work. Finished surfaces at juncture with other pavements shall coincide with finished surfaces of abutting pavements. Deviation from the plan elevation will not be permitted in areas of pavements where closer conformance with planned elevation is required for the proper functioning of drainage and other appurtenant structures involved. The grade will be determined by running lines of levels at intervals of 25 feet, or less, longitudinally and transversely, to determine the elevation of the completed pavement surface.

3.9.3 Surface Smoothness

Use one of the following methods to test and evaluate surface smoothness of the pavement. Perform all testing in the presence of the Contracting Officer. Keep detailed notes of the results of the testing and furnish a copy to the Government immediately after each day's testing. Where drawings show required deviations from a plane surface (crowns, drainage inlets, etc.), the surface shall be finished to meet the approval of the Contracting Officer.

3.9.3.1 Smoothness Requirements

3.9.3.1.1 Straightedge Testing

The finished surfaces of the pavements shall have no abrupt change of 1/4 inch or more, and all pavements shall be within the tolerances of 1/4 inch in both the longitudinal and transverse directions, when tested with an approved 12 feet straightedge.

3.9.3.2 Testing Method

After the final rolling, but not later than 24 hours after placement, test the surface of the pavement in each entire lot in such a manner as to reveal all surface irregularities exceeding the tolerances specified above. Separate testing of individual sublots is not required. If any pavement areas are ground, these areas shall be retested immediately after grinding. Test each lot of the pavement in both a longitudinal and a transverse direction on parallel lines. Set the transverse lines 15 feet or less apart, as directed. The longitudinal lines shall be at the centerline of each paving lane for lanes less than 20 feet wide and at the third points for lanes 20 feet or wider. Also test other areas having obvious deviations. Longitudinal testing lines shall be continuous across all joints.

3.9.3.2.1 Straightedge Testing

Hold the straightedge in contact with the surface and move it ahead

one-half the length of the straightedge for each successive measurement. Determine the amount of surface irregularity by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points.

3.9.3.2.2 Profilograph Testing

Perform profilograph testing using approved equipment and procedures described in CTM 526. The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate "must-grind" bumps and the Profile Index for each 0.1 mile segment of each pavement lot. Grade breaks on parking lots shall be accommodated by breaking the profile segment into shorter sections and repositioning the blanking band on each segment. The "blanking band" shall be 0.2 inches wide and the "bump template" shall span 1 inch with an offset of 0.3 inch. Compute the Profile Index for each pass of the profilograph in each 0.1 mile segment. The Profile Index for each segment shall be the average of the Profile Indices for each pass in each segment. The profilograph shall be operated by a DOT approved operator. Furnish a copy of the reduced tapes to the Government at the end of each day's testing.

-- End of Section --

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SECTION 32 92 19

SEEDING
08/17

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D4972	(2013) pH of Soils

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act	(1940; R 1988; R 1998) Federal Seed Act
DOA SSIR 42	(1996) Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0

1.2 DEFINITIONS

1.2.1 Stand of Turf

95 percent ground cover of the established species.

1.3 RELATED REQUIREMENTS

Section 31 00 00 EARTHWORK applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wood Cellulose Fiber Mulch

Fertilizer

Include physical characteristics, and recommendations.

SD-06 Test Reports

Topsoil Composition Tests (reports and recommendations).

SD-07 Certificates

State Certification and Approval for Seed

SD-08 Manufacturer's Instructions

Erosion Control Materials

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Seed Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.5.1.2 Fertilizer Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer may be furnished in bulk with certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Seed and Fertilizer Storage

Store in cool, dry locations away from contaminants.

1.5.2.2 Topsoil

Prior to stockpiling topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.5.2.3 Handling

Do not drop or dump materials from vehicles.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.6.1 Restrictions

Do not plant when the ground is frozen, muddy, or when air temperature exceeds 90 degrees Fahrenheit.

1.7 TIME LIMITATIONS

1.7.1 Seed

Apply seed within twenty four hours after seed bed preparation.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Classification

Provide State-certified seed of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for

percentages of mixtures, purity, germination, weedseed content, and inert material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected. Field mixes will be acceptable when field mix is performed on site in the presence of the Contracting Officer.

2.1.2 Planting Dates

Planting Season	Planting Dates
Season 1	January 15 to May 15
Temporary Cool Season	September 1 to November 30
Temporary Warm Season	May 1 to August 31

2.1.3 Seed Purity

Botanical Name	Common Name	Minimum Percent Pure Seed	Minimum Percent Germination and Hard Seed	Maximum Percent Weed Seed
Leptochloa Dubis	Van Horn Green Sprangletop	98	96	0.02
Bouteloua Curtipendula	Haskell Sideoats Grama	75	85	0.02
Setaria Vulpiseta	Catarina Blend Bristlegrass	88	84	0.02
Buchloe Dactyloides	Buffalo Grass	97	96	0.00
Cynodan Dactylon	Bermuda Grass	83	85	0.10
Desmanthus Inninoesis	Illinois Bundleflower	98	92	0.00
Avena Sativa	Oats	83	85	0.05
Setaria Italica	German Millet	84	85	0.20

2.1.4 Seed Mixture by Weight

Planting Season	Variety	Percent (by Weight)
Season 1	Van Horn Green Sprangletop Haskell Sideoats Grama Plains Bristlegrass Buffalo Grass Bermuda Grass Illinois Bundleflower	3.4 40.4 13.5 18.0 13.5 11.2
Temporary Cool Season	Oats	100
Temporary Warm Season	Foxtail Millet	100

Proportion seed mixtures by weight. Temporary cool seeding must later be replaced by Season 1 plantings for a permanent stand of grass. The same requirements of turf establishment for Season 1 apply for temporary warm seeding.

2.2 TOPSOIL

2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph COMPOSITION. When available topsoil must be existing surface soil stripped and stockpiled on-site in accordance with Section 31 00 00 EARTHWORK.

2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph COMPOSITION. Additional topsoil must be furnished by the Contractor

2.2.3 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH must be tested in accordance with ASTM D4972. Topsoil must be free of sticks, stones, roots, and other debris and objectionable materials. Other components must conform to the following limits:

Silt	7 to 17 percent
Clay	4 to 12 percent
Sand	70 to 82 percent

pH	5.5 to 7.0
Soluble Salts	600 ppm maximum

2.3 SOIL CONDITIONSe

Add conditioners to topsoil as required to bring into compliance with "composition" standard for topsoil as specified herein.

2.4 FERTILIZER

2.4.1 Hydroseeding Fertilizer

Controlled release fertilizer, to use with hydroseeding and composed of pills coated with plastic resin to provide a continuous release of nutrients for at least 6 months and containing the following minimum percentages, by weight, of plant food nutrients.

15 percent available nitrogen
15 percent available phosphorus
15 percent available potassium

2.5 MULCH

Mulch must be free from noxious weeds, mold, and other deleterious materials.

2.5.1 Wood Cellulose Fiber Mulch

Use recovered materials of either paper-based (100 percent post-consumer content) or wood-based (100 percent total recovered content) hydraulic mulch. Processed to contain no growth or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of materials application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 5.5 to 8.2. Use with hydraulic application of grass seed and fertilizer.

2.6 WATER

Source of water must be approved by Contracting Officer and of suitable quality for irrigation, containing no elements toxic to plant life.

2.7 EROSION CONTROL MATERIALS

Erosion control material must conform to the following:

2.7.1 Erosion Control Blanket

[100 percent agricultural straw] 70 percent agricultural straw/30 percent coconut fiber matrix stitched with a degradable nettings, designed to degrade within 12 months 18 months.

2.7.2 Erosion Control Fabric

Fabric must be knitted construction of polypropylene yarn with uniform mesh openings 3/4 to 1 inch square with strips of biodegradable paper. Filler paper strips must have a minimum life of 6 months.

2.7.3 Erosion Control Net

Net must be heavy, twisted jute mesh, weighing approximately 1.22 pounds per linear yard and 4 feet wide with mesh openings of approximately one inch square.

2.7.4 Hydrophilic Colloids

Hydrophilic colloids must be physiologically harmless to plant and animal life without phytotoxic agents. Colloids must be naturally occurring, silicate powder based, and must form a water insoluble membrane after curing. Colloids must resist mold growth.

2.7.5 Erosion Control Material Anchors

Erosion control anchors must be as recommended by the manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 EXTENT OF WORK

Provide soil preparation prior to planting (including soil conditioners as required), fertilizing, seeding, and surface topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.1.1.1 Topsoil

Provide 4 inches of off-site topsoil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate fertilizer into soil a minimum depth of 4 inches by disking, harrowing, tilling or other method approved by the Contracting Officer. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.1.1.2 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site. For bidding purposes only apply at rates for the following:

Hydroseeding Fertilizer 20 pounds per 1000 square feet.

3.2 SEEDING

3.2.1 Seed Application Seasons and Conditions

Immediately before seeding, restore soil to proper grade. Do not seed when ground is muddy, frozen, snow covered or in an unsatisfactory condition for seeding. If special conditions exist that may warrant a variance in the above seeding dates or conditions, submit a written request to the Contracting Officer stating the special conditions and proposed variance. Apply seed within twenty four hours after seedbed preparation. Sow seed by approved sowing equipment. Sow one-half the seed in one direction, and sow

remainder at right angles to the first sowing.

3.2.2 Seed Application Method

Seeding method shall be hydroseeding.

3.2.2.1 Hydroseeding

First, mix water and fiber. Wood cellulose fiber, paper fiber, or recycled paper must be applied as part of the hydroseeding operation. Fiber must be added at 1,000 pounds, dry weight, per acre. Then add and mix seed and fertilizer to produce a homogeneous slurry. Seed must be mixed to ensure broadcasting at the rate of 0.21 pounds per 1000 square feet. When hydraulically sprayed on the ground, material must form a blotter like cover impregnated uniformly with grass seed. Spread with one application with no second application of mulch.

3.2.3 Erosion Control Material

Install in accordance with manufacturer's instructions, where indicated or as directed by the Contracting Officer.

3.2.4 Watering

Start watering areas seeded as required by temperature and wind conditions. Apply water at a rate sufficient to insure thorough wetting of soil to a depth of 2 inches without run off. During the germination process, seed is to be kept actively growing and not allowed to dry out.

3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

3.4 RENOVATION OF EXISTING TURF AREA

3.4.1 Overseeding

Apply seed in accordance with and at rates indicated in applicable portions of paragraph SEED APPLICATION METHOD.

3.5 RESTORATION

Restore to original condition existing turf areas which have been damaged during turf installation operations at the Contractor's expense. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work in adjacent areas is complete.

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SECTION 33 71 02

UNDERGROUND ELECTRICAL DISTRIBUTION
02/15

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO HB-17 (2002; Errata 2003; Errata 2005, 17th Edition) Standard Specifications for Highway Bridges

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 318M (2014; ERTA 2015) Building Code Requirements for Structural Concrete & Commentary

ACI SP-66 (2004) ACI Detailing Manual

ASTM INTERNATIONAL (ASTM)

ASTM B1 (2013) Standard Specification for Hard-Drawn Copper Wire

ASTM B3 (2013) Standard Specification for Soft or Annealed Copper Wire

ASTM B8 (2011; R 2017) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

ASTM C309 (2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

ASTM C32 (2013) Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)

ASTM C478 (2015a) Standard Specification for Precast Reinforced Concrete Manhole Sections

ASTM C857 (2016) Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

ASTM C990 (2009; R 2014) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed

Flexible Joint Sealants

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 81	(2012) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2017) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C119.1	(2016) Electric Connectors - Sealed Insulated Underground Connector Systems Rated 600 Volts
NEMA RN 1	(2005; R 2013) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 2	(2013) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 3	(2016) Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit and Tubing
NEMA TC 9	(2004) Standard for Fittings for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation
NEMA WC 70	(2009) Power Cable Rated 2000 V or Less for the Distribution of Electrical Energy--S95-658

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14) National Electrical Code

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-758	(2012b) Customer-Owned Outside Plant Telecommunications Infrastructure Standard

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS Bull 1751F-644	(2002) Underground Plant Construction

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-60005	(Basic; Notice 2) Frames, Covers, Gratings, Steps, Sump And Catch Basin, Manhole

UNDERWRITERS LABORATORIES (UL)

UL 1242	(2006; Reprint Mar 2014) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 486A-486B	(2013; Reprint Jan 2016) Wire Connectors
UL 510	(2017) UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514A	(2013; Reprint Aug 2017) UL Standard for Safety Metallic Outlet Boxes
UL 514B	(2012; Reprint Nov 2014) Conduit, Tubing and Cable Fittings
UL 6	(2007; Reprint Nov 2014) Electrical Rigid Metal Conduit-Steel
UL 651	(2011; Reprint Jun 2016) UL Standard for Safety Schedule 40 and 80 Rigid PVC Conduit and Fittings
UL 854	(2004; Reprint Nov 2014) Standard for Service-Entrance Cables
UL 94	(2013; Reprint Mar 2016) UL Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

1.2 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE Stds Dictionary.

b. In the text of this section, the words conduit and duct are used interchangeably and have the same meaning.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Precast underground structures

SD-03 Product Data

Precast concrete structures

Sealing Material

Pulling-In Irons

Manhole frames and covers

Handhole frames and covers

Cable supports (racks, arms and insulators)

SD-06 Test Reports

Field Acceptance Checks and Tests

Arc-proofing test for cable fireproofing tape

Cable Installation Plan and Procedure

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings from which material may readily be removed and replaced, including a separate section for each cable pull. Separate sections by heavy plastic dividers with tabs, with all data sheets signed and dated by the person supervising the pull.

a. Site layout drawing with cable pulls numerically identified.

b. A list of equipment used, with calibration certifications. The manufacturer and quantity of lubricant used on pull.

c. The cable manufacturer and type of cable.

d. The dates of cable pulls, time of day, and ambient temperature.

e. The length of cable pull and calculated cable pulling tensions.

f. The actual cable pulling tensions encountered during pull.

SD-07 Certificates

Cable Installer Qualifications

1.4 QUALITY ASSURANCE

1.4.1 Precast Underground Structures

Submittal required for each type used. Provide calculations and drawings for precast manholes and handholes bearing the seal of a registered

professional engineer including:

a. Material description (i.e., f'c and Fy)

b. Manufacturer's printed assembly and installation instructions

c. Design calculations

d. Reinforcing shop drawings in accordance with ACI SP-66

e. Plans and elevations showing opening and pulling-in iron locations and details

1.4.2 Cable Installer Qualifications

Provide at least one onsite person in a supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. Provide a resume showing the cable installers' experience in the last three years, including a list of references complete with points of contact, addresses and telephone numbers. Cable installer must demonstrate experience with a minimum of three medium voltage cable installations. The Contracting Officer reserves the right to require additional proof of competency or to reject the individual and call for an alternate qualified cable installer.

1.4.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship must be in accordance with the mandatory and advisory provisions of IEEE C2 and NFPA 70 unless more stringent requirements are specified or indicated.

1.4.4 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products must have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period must include applications of equipment and materials under similar circumstances and of similar size. The product must have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items must be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not acceptable, unless specified otherwise.

PART 2 PRODUCTS

2.1 CONDUIT, DUCTS, AND FITTINGS

2.1.1 Rigid Metal Conduit

UL 6.

2.1.1.1 Rigid Metallic Conduit, PVC Coated

NEMA RN 1, Type A40, except that hardness must be nominal 85 Shore A durometer, dielectric strength must be minimum 400 volts per mil at 60 Hz, and tensile strength must be minimum 3500 psi.

2.1.2 Intermediate Metal Conduit

UL 1242.

2.1.2.1 Intermediate Metal Conduit, PVC Coated

NEMA RN 1, Type A40, except that hardness must be nominal 85 Shore A durometer, dielectric strength must be minimum 400 volts per mil at 60 Hz, and tensile strength must be minimum 3500 psi.

2.1.3 Plastic Conduit for Direct Burial and Riser Applications

UL 651 and NEMA TC 2, EPC-80.

2.1.4 Plastic Duct for Concrete Encasement

Provide Type EPC-40 per UL 651 and NEMA TC 2.

2.1.5 Innerduct

Provide fabric-mesh innerducts, with pullwire.

2.1.6 Duct Sealant

UL 94, Class HBF. Provide high-expansion urethane foam duct sealant that expands and hardens to form a closed, chemically and water resistant, rigid structure. Sealant must be compatible with common cable and wire jackets and capable of adhering to metals, plastics and concrete. Sealant must be capable of curing in temperature ranges of 35 degrees F to 95 degrees F. Cured sealant must withstand temperature ranges of -20 degrees F to 200 degrees F without loss of function.

2.1.7 Fittings

2.1.7.1 Metal Fittings

UL 514B.

2.1.7.2 PVC Conduit Fittings

NEMA TC 3.

2.1.7.3 PVC Duct Fittings

NEMA TC 9.

2.1.7.4 Outlet Boxes for Steel Conduit

Outlet boxes for use with rigid or flexible steel conduit must be cast-metal cadmium or zinc-coated if of ferrous metal with gasketed closures and must conform to UL 514A.

2.2 LOW VOLTAGE INSULATED CONDUCTORS AND CABLES

Insulated conductors must be rated 600 volts and conform to the requirements of NFPA 70, including listing requirements, or in accordance with NEMA WC 70. Wires and cables manufactured more than 24 months prior to date of delivery to the site are not acceptable. Service entrance conductors must conform to UL 854, type USE.

2.2.1 Conductor Types

Cable and duct sizes for copper conductors type XHHW unless otherwise noted.

2.2.2 Conductor Material

Unless specified or indicated otherwise or required by NFPA 70, wires in conduit, other than service entrance, must be 600-volt, Type XHHW. Copper conductors must be annealed copper complying with ASTM B3 and ASTM B8.

2.2.3 In Duct

Cables must be single-conductor cable.

2.2.4 Cable Marking

Insulated conductors must have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout the cable length.

Identify each cable by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag must contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

Conductors must be color coded. Provide conductor identification within each enclosure where a tap, splice, or termination is made. Conductor identification must be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, heat shrink type sleeves,or colored electrical tape. Control circuit terminations must be properly identified. Color must be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals must be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems must be as follows:

a. 480/277 volt, three-phase

(1) Phase A - brown

(2) Phase B - orange

(3) Phase C - yellow

b. 120/240 volt, single phase: Black and red

2.3 LOW VOLTAGE WIRE CONNECTORS AND TERMINALS

Must provide a uniform compression over the entire conductor contact surface. Use solderless terminal lugs on stranded conductors.

a. For use with copper conductors: UL 486A-486B.

2.4 LOW VOLTAGE SPLICES

Provide splices in conductors with a compression connector on the conductor and by insulating and waterproofing using one of the following methods which are suitable for continuous submersion in water and comply with ANSI C119.1.

2.4.1 Heat Shrinkable Splice

Provide heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material applied in accordance with the manufacturer's written instructions.

2.4.2 Cold Shrink Rubber Splice

Provide a cold-shrink rubber splice which consists of EPDM rubber tube which has been factory stretched onto a spiraled core which is removed during splice installation. The installation must not require heat or flame, or any additional materials such as covering or adhesive. It must be designed for use with inline compression type connectors, or indoor, outdoor, direct-burial or submerged locations.

2.5 TAPE

2.5.1 Insulating Tape

UL 510, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

2.5.2 Buried Warning and Identification Tape

Provide detectable tape in accordance with Section 31 00 00 EARTHWORK.

2.5.3 Fireproofing Tape

Provide tape composed of a flexible, conformable, unsupported intumescent elastomer. Tape must be not less than .030 inch thick, noncorrosive to cable sheath, self-extinguishing, noncombustible, adhesive-free, and must not deteriorate when subjected to oil, water, gases, salt water, sewage, and fungus.

2.6 PULL ROPE

Plastic or flat pull line (bull line) having a minimum tensile strength of 200 pounds.

2.7 GROUNDING AND BONDING

2.7.1 Driven Ground Rods

Provide solid stainless steel ground rods not less than 3/4 inch in diameter by 10 feet in length.

2.7.2 Grounding Conductors

Stranded-bare copper conductors must conform to ASTM B8, Class B, soft-drawn unless otherwise indicated. Solid-bare copper conductors must conform to ASTM B1 for sizes No. 8 and smaller. Insulated conductors must be of the same material as phase conductors and green color-coded, except that conductors must be rated no more than 600 volts. Aluminum is not acceptable.

2.8 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE. In addition, provide concrete for encasement of underground ducts with 3000 psi minimum 28-day compressive strength. Concrete associated with electrical work for other than encasement of underground ducts must be 4000 psi minimum 28-day compressive strength unless specified otherwise.

2.9 UNDERGROUND STRUCTURES

Provide precast concrete underground structures or standard type cast-in-place manhole types as indicated, conforming to ASTM C857 and ASTM C478. Top, walls, and bottom must consist of reinforced concrete. Walls and bottom must be of monolithic concrete construction. Locate duct entrances and windows near the corners of structures to facilitate cable racking. Covers must fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings must be free from warp and blow holes that may impair strength or appearance. Exposed metal must have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Install a pulling-in iron in the wall opposite each duct line entrance. Cable racks, including rack arms and insulators, must be adequate to accommodate the cable. Structures within the enforcement zone will be lockable type. All structures shall be rated for heavy vehicular traffic.

2.9.1 Cast-In-Place Concrete Structures

Concrete must conform to Section 03 30 00 CAST-IN-PLACE CONCRETE.

2.9.2 Precast Concrete Structures, Risers and Tops

Precast concrete underground structures may be provided in lieu of cast-in-place subject to the requirements specified below. Precast units must be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes.

2.9.2.1 General

Precast concrete structures must have the same accessories and facilities as required for cast-in-place structures. Likewise, precast structures must have plan area and clear heights not less than those of cast-in-place structures. Concrete materials and methods of construction must be the same as for cast-in-place concrete construction, as modified herein. Slope in floor may be omitted provided precast sections are poured in reinforced steel forms. Concrete for precast work must have a 28-day compressive strength of not less than 4000 psi. Structures may be precast to the design and details indicated for cast-in-place construction, precast monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the manufacturer in accordance with the requirements specified. Structures must be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.

2.9.2.2 Design for Precast Structures

ACI 318M. In the absence of detailed on-site soil information, design for the following soil parameters/site conditions:

a. Angle of Internal Friction (phi) = 30 degrees

b. Unit Weight of Soil (Dry) = 110 pcf, (Saturated) = 130 pcf

c. Coefficient of Lateral Earth Pressure (Ka) = 0.33

d. Ground Water Level = 3 feet below ground elevation

e. Vertical design loads must include full dead, superimposed dead, and live loads including a 30 percent magnification factor for impact. Live loads must consider all types and magnitudes of vehicular (automotive, industrial, or aircraft) traffic to be encountered. The minimum design vertical load must be for H20 highway loading per AASHTO HB-17.

f. Horizontal design loads must include full geostatic and hydrostatic pressures for the soil parameters, water table, and depth of installation to be encountered. Also, horizontal loads imposed by adjacent structure foundations, and horizontal load components of vertical design loads, including impact, must be considered, along with a pulling-in iron design load of 6000 pounds.

g. Each structural component must be designed for the load combination and positioning resulting in the maximum shear and moment for thatparticular component.

h. Design must also consider the live loads induced in the handling, installation, and backfilling of the manholes. Provide lifting devices to ensure structural integrity during handling and installation.

2.9.2.3 Construction

Structure top, bottom, and wall must be of a uniform thickness of not less than 6 inches. Thin-walled knock-out panels for designed or future duct bank entrances are not permitted. Provide quantity, size, and location of duct bank entrance windows as directed, and cast completely open by the

precaster. Size of windows must exceed the nominal duct bank envelope dimensions by at least 12 inches vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment. However, the sides of precast windows must be a minimum of 6 inches from the inside surface of adjacent walls, floors, or ceilings. Form the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes. Provide additional reinforcing steel comprised of at least two No. 4 bars around window openings. Provide drain sumps a minimum of 12 inches in diameter and 4 inches deep for precast structures.

2.9.2.4 Joints

Provide tongue-and-groove joints on mating edges of precast components. Shiplap joints are not allowed. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Seal joints watertight using preformed plastic strip conforming to ASTM C990. Install sealing material in strict accordance with the sealant manufacturer's printed instructions. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.

2.9.3 Manhole Frames and Covers

Provide cast iron frames and covers for manholes conforming to CID A-A-60005. Cast the words "ELECTRIC" or "TELECOMMUNICATIONS" in the top face of power and telecommunications manhole covers, respectively. Structures within the enforcement zone will be lockable type. All structures shall be rated for heavy vehicular traffic.

2.9.4 Handhole Frames and Covers

Frames and covers of steel must be welded by qualified welders in accordance with standard commercial practice. Steel covers must be rolled-steel floor plate having an approved antislip surface. Hinges must be of stainless steel with bronze hinge pin, 5 by 5 inches by approximately 3/16 inch thick, without screw holes, and must be for full surface application by fillet welding. Hinges must have nonremovable pins and five knuckles. The surfaces of plates under hinges must be true after the removal of raised antislip surface, by grinding or other approved method.

Structures within the enforcement zone will be lockable type. All structures shall be rated for heavy vehicular traffic.

2.9.5 Brick for Manhole Collar

Provide sewer and manhole brick conforming to ASTM C32, Grade MS.

2.10 CABLE SUPPORTS (RACKS, ARMS, AND INSULATORS)

The metal portion of racks and arms must be zinc-coated after fabrication.

2.10.1 Cable Rack Stanchions

The wall bracket or stanchion must be 4 inches by approximately 1-1/2 inch by 3/16 inch channel steel, or 4 inches by approximately 1 inch glass-reinforced nylon with recessed bolt mounting holes, 48 inches long

(minimum) in manholes. Slots for mounting cable rack arms must be spaced at 8 inch intervals.

2.10.2 Rack Arms

Cable rack arms must be steel or malleable iron or glass reinforced nylon and must be of the removable type. Rack arm length must be a minimum of 8 inches and a maximum of 12 inches.

2.10.3 Insulators

Insulators for metal rack arms must be dry-process glazed porcelain. Insulators are not required for nylon arms.

2.11 CABLE TAGS IN MANHOLES

Provide tags for each power cable located in manholes. The tags must be polyethylene. Do not provide handwritten letters. The first position on the power cable tag must denote the voltage. The second through sixth positions on the tag must identify the circuit. The next to last position must denote the phase of the circuit and include the Greek "phi" symbol. The last position must denote the cable size. As an example, a tag could have the following designation: "11.5 NAS 1-8(Phase A)500," denoting that the tagged cable is on the 11.5kV system circuit number NAS 1-8, underground, Phase A, sized at 500 kcmil.

2.11.1 Polyethylene Cable Tags

Provide tags of polyethylene that have an average tensile strength of 3250 pounds per square inch; and that are 0.08 inch thick (minimum), non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 170 degrees F. Provide 0.05 inch (minimum) thick black polyethylene tag holder. Provide a one-piece nylon, self-locking tie at each end of the cable tag. Ties must have a minimum loop tensile strength of 175 pounds. The cable tags must have black block letters, numbers, and symbols one inch high on a yellow background. Letters, numbers, and symbols must not fall off or change positions regardless of the cable tags' orientation.

2.12 SOURCE QUALITY CONTROL

2.12.1 Arc-Proofing Test for Cable Fireproofing Tape

Manufacturer must test one sample assembly consisting of a straight lead tube 12 inches long with a 2 1/2 inch outside diameter, and a 1/8 inch thick wall, and covered with one-half lap layer of arc and fireproofing tape per manufacturer's instructions. The arc and fireproofing tape must withstand extreme temperature of a high-current fault arc 13,000 degrees K for 70 cycles as determined by using an argon directed plasma jet capable of constantly producing and maintaining an arc temperature of 13,000 degrees K. Temperature (13,000 degrees K) of the ignited arc between the cathode and anode must be obtained from a dc power source of 305 (plus or minus 5) amperes and 20 (plus or minus 1) volts. The arc must be directed toward the sample assembly accurately positioned 5 (plus or minus 1) millimeters downstream in the plasma from the anode orifice by fixed flow rate of argon gas (0.18 g per second). Each sample assembly must be tested at three unrelated points. Start time for tests must be taken from recorded peak current when the specimen is exposed to the full test temperature. Surface heat on the specimen prior to that time must be

minimal. The end point is established when the plasma or conductive arc penetrates the protective tape and strikes the lead tube. Submittals for arc-proofing tape must indicate that the test has been performed and passed by the manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment and devices in accordance with the manufacturer's published instructions and with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable. In addition to these requirements, install telecommunications in accordance with TIA-758 and RUS Bull 1751F-644.

3.2 CABLE INSPECTION

Inspect each cable reel for correct storage positions, signs of physical damage, and broken end seals prior to installation. If end seal is broken, remove moisture from cable prior to installation in accordance with the cable manufacturer's recommendations.

3.3 CABLE INSTALLATION PLAN AND PROCEDURE

Obtain from the manufacturer an installation manual or set of instructions which addresses such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature limits for installation, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, maximum allowable pulling tension, and maximum allowable sidewall bearing pressure. Prepare a checklist of significant requirements. Perform pulling calculations and prepare a pulling plan and submit along with the manufacturer's instructions in accordance with SUBMITTALS. Install cable strictly in accordance with the cable manufacturer's recommendations and the approved installation plan.

Calculations and pulling plan must include:

a. Site layout drawing with cable pulls identified in numeric order of expected pulling sequence and direction of cable pull.

b. List of cable installation equipment.

c. Lubricant manufacturer's application instructions.

d. Procedure for resealing cable ends to prevent moisture from entering cable.

e. Cable pulling tension calculations of all cable pulls.

f. Cable percentage conduit fill.

g. Cable sidewall bearing pressure.

h. Cable minimum bend radius and minimum diameter of pulling wheels used.

i. Cable jam ratio.

j. Maximum allowable pulling tension on each different type and size of conductor.

k. Maximum allowable pulling tension on pulling device.

3.4 UNDERGROUND STRUCTURE CONSTRUCTION

Provide standard type cast-in-place construction as specified herein and as indicated, or precast construction as specified herein. Horizontal concrete surfaces of floors must have a smooth trowel finish. Cure concrete by applying two coats of white pigmented membrane forming-curing compound in strict accordance with the manufacturer's printed instructions, except that precast concrete may be steam cured. Curing compound must conform to ASTM C309. Locate duct entrances and windows in the center of end walls (shorter) and near the corners of sidewalls (longer) to facilitate cable racking and splicing. Covers for underground structures must fit the frames without undue play. Steel and iron must be formed to shape and size with sharp lines and angles. Castings must be free from warp and blow holes that may impair strength or appearance. Exposed metal must have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Manhole locations, as indicated, are approximate. Coordinate exact manhole locations with other utilities and finished grading and paving.

3.4.1 Precast Concrete Construction

Set commercial precast structures on 6 inches of level, 90 percent compacted granular fill, 3/4 inch to 1 inch size, extending 12 inches beyond the structure on each side. Compact granular fill by a minimum of four passes with a plate type vibrator. Installation must additionally conform to the manufacturer's instructions.

3.4.2 Pulling-In Irons

Provide steel bars bent as indicated, and cast in the walls and floors. Alternatively, pipe sleeves may be precast into the walls and floors where required to accept U-bolts or other types of pulling-in devices possessing the strengths and clearances stated herein. The final installation of pulling-in devices must be made permanent. Cover and seal exterior projections of thru-wall type pulling-in devices with an appropriate protective coating. In the floor the irons must be a minimum of 6 inches from the edge of the sump, and in the walls the irons must be located within 6 inches of the projected center of the duct bank pattern or precast window in the opposite wall. However, the pulling-in iron must not be located within 6 inches of an adjacent interior surface, or duct or precast window located within the same wall as the iron. If a pulling-in iron cannot be located directly opposite the corresponding duct bank or precast window due to this clearance limitation, locate the iron directly above or below the projected center of the duct bank pattern or precast window the minimum distance required to preserve the 6 inch clearance previously stated. In the case of directly opposing precast windows, pulling-in irons consisting of a 3 foot length of No. 5 reinforcing bar, formed into a hairpin, may be cast-in-place within the precast windows simultaneously with the end of the corresponding duct bank envelope. Irons installed in this manner must be positioned directly in line with, or when not possible, directly above or below the projected center of the duct bank pattern entering the opposite wall, while maintaining a minimum clear distance of 3 inches from any edge of the cast-in-place duct bank envelope or any individual duct. Pulling-in irons must have a clear projection into the structure of approximately 4 inches and must be designed to withstand a

minimum pulling-in load of 6000 pounds. Irons must be hot-dipped galvanized after fabrication.

3.4.3 Cable Racks, Arms and Insulators

Cable racks, arms and insulators must be sufficient to accommodate the cables. Space racks in power manholes not more than 3 feet apart, and provide each manhole wall with a minimum of two racks. Space racks in signal manholes not more than 16 1/2 inches apart with the end rack being no further than 12 inches from the adjacent wall. Methods of anchoring cable racks must be as follows:

a. Provide a 5/8 inch diameter by 5 inch long anchor bolt with 3 inch foot cast in structure wall with 2 inch protrusion of threaded portion of bolt into structure. Provide 5/8 inch steel square head nut on each anchor bolt. Coat threads of anchor bolts with suitable coating immediately prior to installing nuts.

b. Provide concrete channel insert with a minimum load rating of 800 pounds per foot. Insert channel must be steel of the same length as "vertical rack channel;" channel insert must be cast flush in structure wall. Provide 5/8 inch steel nuts in channel insert to receive 5/8 inch diameter by 3 inch long steel, square head anchor bolts.

c. Provide concrete "spot insert" at each anchor bolt location, cast flush in structure wall. Each insert must have minimum 800 pound load rating. Provide 5/8 inch diameter by 3 inch long steel, square head anchor bolt at each anchor point. Coat threads of anchor bolts with suitable coating immediately prior to installing bolts.

3.4.4 Field Painting

Cast-iron frames and covers not buried in concrete or masonry must be cleaned of mortar, rust, grease, dirt and other deleterious materials, and given a coat of bituminous paint.

3.5 UNDERGROUND CONDUIT AND DUCT SYSTEMS

3.5.1 Requirements

Run conduit in straight lines except where a change of direction is necessary. Provide numbers and sizes of ducts as indicated. Bond bare copper grounding conductor to ground rings (loops) in all manholes and to ground rings (loops) at all equipment slabs (pads). Route grouding conductor into manholes with the duct bank (sleeving is not required). Ducts must have a continuous slope downward toward underground structures and away from buildings, laid with a minimum slope of 3 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Provide ducts with end bells whenever duct lines terminate in structures.

Perform changes in ductbank direction as follows:

a. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable.

b. The minimum manufactured bend radius must be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter.

c. As an exception to the bend radius required above, provide field manufactured longsweep bends having a minimum radius of 25 feet for a change of direction of more than 5 degrees, either horizontally or vertically, using a combination of curved and straight sections. Maximum manufactured curved sections: 30 degrees.

3.5.2 Treatment

Ducts must be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers must be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer must be used whenever an existing duct is connected to a duct of different material or shape. Ducts must be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts must be thoroughly cleaned before being laid. Plastic ducts must be stored on a flat surface and protected from the direct rays of the sun.

3.5.3 Conduit Cleaning

As each conduit run is completed, for conduit sizes 3 inches and larger, draw a flexible testing mandrel approximately 12 inches long with a diameter less than the inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs. For conduit sizes less than 3 inches, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs.

3.5.4 Galvanized Conduit Concrete Penetrations

Galvanized conduits which penetrate concrete (slabs, pavement, and walls) in wet locations must be PVC coated and must extend from at least 2 inches within the concrete to the first coupling or fitting outside the concrete (minimum of 6 inches from penetration).

3.5.5 Multiple Conduits

Separate multiple conduits by a minimum distance of 3 inches, except that light and power conduits must be separated from control, signal, and telephone conduits by a minimum distance of 12 inches. Stagger the joints of the conduits by rows (horizontally) and layers (vertically) to strengthen the conduit assembly. Provide plastic duct spacers that interlock vertically and horizontally. Spacer assembly must consist of base spacers, intermediate spacers, ties, and locking device on top to provide a completely enclosed and locked-in conduit assembly. Install spacers per manufacturer's instructions, but provide a minimum of two spacer assemblies per 10 feet of conduit assembly.

3.5.6 Conduit Plugs and Pull Rope

New conduit indicated as being unused or empty must be provided with plugs on each end. Plugs must contain a weephole or screen to allow water drainage. Provide a plastic pull rope having 3 feet of slack at each end of unused or empty conduits.

3.5.7 Conduit and Duct Without Concrete Encasement

Depths to top of the conduit must be not less than 24 inches below finished grade. Provide not less than 3 inches clearance from the conduit to each side of the trench. Grade bottom of trench smooth; where rock, soft spots, or sharp-edged materials are encountered, excavate the bottom for an additional 3 inches, fill and tamp level with original bottom with sand or earth free from particles, that would be retained on a 1/4 inch sieve. The first 6 inch layer of backfill cover must be sand compacted as previously specified. The rest of the excavation must be backfilled and compacted in 3 to 6 inch layers.

3.5.7.1 Encasement Under Roads and Structures

Under roads, paved areas, and railroad tracks, install conduits in concrete encasement of rectangular cross-section providing a minimum of 3 inch concrete cover around ducts. Concrete encasement must extend at least 5 feet beyond the edges of paved areas and roads, and 12 feet beyond the rails on each side of railroad tracks. Depths to top of the concrete envelope must be not less than 24 inches below finished grade.

3.5.8 Duct Encased in Concrete

Construct underground duct lines of individual conduits encased in concrete. Do not mix different kinds of conduit in any one duct bank. Concrete encasement surrounding the bank must be rectangular in cross-section and must provide at least 3 inches of concrete cover for ducts. Separate conduits by a minimum concrete thickness of 3 inches. Before pouring concrete, anchor duct bank assemblies to prevent the assemblies from floating during concrete pouring. Anchoring must be done by driving reinforcing rods adjacent to duct spacer assemblies and attaching the rods to the spacer assembly. Provide steel reinforcing in the concrete envelope as indicated.

3.5.8.1 Connections to Manholes

Duct bank envelopes connecting to underground structures must be flared to have enlarged cross-section at the manhole entrance to provide additional shear strength. Dimensions of the flared cross-section must be larger than the corresponding manhole opening dimensions by no less than 12 inches in each direction. Perimeter of the duct bank opening in the underground structure must be flared toward the inside or keyed to provide a positive interlock between the duct bank and the wall of the structure. Use vibrators when this portion of the encasement is poured to assure a seal between the envelope and the wall of the structure.

3.5.9 Duct Sealing

Seal all electrical penetrations for radon mitigation, maintaining integrity of the vapor barrier, and to prevent infiltration of air, insects, and vermin.

3.6 CABLE PULLING

Test existing duct lines with a mandrel and thoroughly swab out to remove foreign material before pulling cables. Pull cables down grade with the feed-in point at the manhole or buildings of the highest elevation. Use flexible cable feeds to convey cables through manhole opening and into duct runs. Do not exceed the specified cable bending radii when installing

cable under any conditions, including turnups into switches, transformers, switchgear, switchboards, and other enclosures. Cable with tape or wire shield must have a bending radius not less than 12 times the overall diameter of the completed cable. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

3.6.1 Cable Lubricants

Use lubricants that are specifically recommended by the cable manufacturer for assisting in pulling jacketed cables.

3.7 CABLES IN UNDERGROUND STRUCTURES

Do not install cables utilizing the shortest path between penetrations, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support on brackets and cable insulators. Support cable splices in underground structures by racks on each side of the splice. Locate splices to prevent cyclic bending in the spliced sheath. Install cables at middle and bottom of cable racks, leaving top space open for future cables, except as otherwise indicated for existing installations. Provide one spare three-insulator rack arm for each cable rack in each underground structure.

3.7.1 Cable Tag Installation

Install cable tags in each manhole as specified, including each splice. Tag wire and cable provided by this contract. Install cable tags over the fireproofing, if any, and locate the tags so that they are clearly visible without disturbing any cabling or wiring in the manholes.

3.8 CONDUCTORS INSTALLED IN PARALLEL

Conductors must be grouped such that each conduit of a parallel run contains 1 Phase A conductor, 1 Phase B conductor, 1 Phase C conductor, and 1 neutral conductor.

3.9 LOW VOLTAGE CABLE SPLICING AND TERMINATING

Make terminations and splices with materials and methods as indicated or specified herein and as designated by the written instructions of the manufacturer. Do not allow the cables to be moved until after the splicing material has completely set. Make splices in underground distribution systems only in accessible locations such as manholes, handholes, or aboveground termination pedestals.

3.10 CABLE END CAPS

Cable ends must be sealed at all times with coated heat shrinkable end caps. Cables ends must be sealed when the cable is delivered to the job site, while the cable is stored and during installation of the cable. The caps must remain in place until the cable is spliced or terminated. Sealing compounds and tape are not acceptable substitutes for heat shrinkable end caps. Cable which is not sealed in the specified manner at all times will be rejected.

3.11 FIREPROOFING OF CABLES IN UNDERGROUND STRUCTURES

Fireproof (arc proof) wire and cables which will carry current at 2200 volts or more in underground structures.

3.11.1 Fireproofing Tape

Tightly wrap strips of fireproofing tape around each cable spirally in half-lapped wrapping. Install tape in accordance with manufacturer's instructions.

3.11.2 Tape-Wrap

Tape-wrap metallic-sheathed or metallic armored cables without a nonmetallic protective covering over the sheath or armor prior to application of fireproofing. Wrap must be in the form of two tightly applied half-lapped layers of a pressure-sensitive 10 mil thick plastic tape, and must extend not less than one inch into the duct. Even out irregularities of the cable, such as at splices, with insulation putty before applying tape.

3.12 GROUNDING SYSTEMS

NFPA 70 and IEEE C2, except provide grounding systems with a resistance to solid earth ground not exceeding 25 ohms.

3.12.1 Grounding Electrodes

Provide cone pointed driven ground rods driven full depth plus 6 inches, installed to provide an earth ground of the appropriate value for the particular equipment being grounded.
If the specified ground resistance is not met, an additional ground rod must be provided in accordance with the requirements of NFPA 70 (placed not less than 6 feet from the first rod). Should the resultant (combined) resistance exceed the specified resistance, measured not less than 48 hours after rainfall, notify the Contracting Officer immediately.

3.12.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or compression connector.

a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.

b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Tools and dies must be as recommended by the manufacturer. An embossing die code or other standard method must provide visible indication that a connector has been adequately compressed on the ground wire.

3.12.3 Grounding Conductors

Provide bare grounding conductors, except where installed in conduit with associated phase conductors. Ground cable sheaths, cable shields, conduit, and equipment with No. 6 AWG. Ground other noncurrent-carrying metal parts and equipment frames of metal-enclosed equipment. Ground metallic frames

and covers of handholes and pull boxes with a braided, copper ground strap with equivalent ampacity of No. 6 AWG.

3.12.4 Ground Cable Crossing Expansion Joints

Protect ground cables crossing expansion joints or similar separations in structures and pavements by use of approved devices or methods of installation which provide the necessary slack in the cable across the joint to permit movement. Use stranded or other approved flexible copper cable across such separations.

3.12.5 Manhole Grounding

Loop a 4/0 AWG grounding conductor around the interior perimeter, approximately 12 inches above finished floor. Secure the conductor to the manhole walls at intervals not exceeding 36 inches. Connect the conductor to the manhole grounding electrode with 4/0 AWG conductor. Connect all incoming 4/0 grounding conductors to the ground loop adjacent to the point of entry into the manhole. Bond the ground loop to all cable shields, metal cable racks, and other metal equipment with a minimum 6 AWG conductor.

3.12.6 Fence Grounding

Provide grounding for fences as indicated. Drive ground rods until the top is 12 inches below grade. Attach a No. 4 AWG copper conductor, by exothermic weld to the ground rods and extend underground to the immediate vicinity of fence post. Lace the conductor vertically into 12 inches of fence mesh and fasten by two approved bronze compression fittings, one to bond wire to post and the other to bond wire to fence. Each gate section must be bonded to its gatepost by a 1/8 by one inch flexible braided copper strap and ground post clamps. Clamps must be of the anti-electrolysis type.

3.13 EXCAVATING, BACKFILLING, AND COMPACTING

Provide in accordance with NFPA 70 and Section 31 00 00 EARTHWORK.

3.13.1 Reconditioning of Surfaces

3.13.1.1 Unpaved Surfaces

Restore to their original elevation and condition unpaved surfaces disturbed during installation of duct. Preserve sod and topsoil removed during excavation and reinstall after backfilling is completed. Replace sod that is damaged by sod of quality equal to that removed. When the surface is disturbed in a newly seeded area, re-seed the restored surface with the same quantity and formula of seed as that used in the original seeding, and provide topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching.

3.13.1.2 Paving Repairs

Where trenches, pits, or other excavations are made in existing roadways and other areas of pavement where surface treatment of any kind exists, restore such surface treatment or pavement the same thickness and in the same kind as previously existed, except as otherwise specified, and to match and tie into the adjacent and surrounding existing surfaces.

3.14 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE for Army projects.

3.14.1 Concrete Slabs (Pads) for Equipment

Unless otherwise indicated, the slab must be at least 8 inches thick, reinforced with a 6 by 6 - W2.9 by W2.9 mesh, placed uniformly 4 inches from the top of the slab. Slab must be placed on a 6 inch thick, well-compacted gravel base. Top of concrete slab must be approximately 4 inches above finished grade with gradual slope for drainage. Edges above grade must have 1/2 inch chamfer. Slab must be of adequate size to project at least 8 inches beyond the equipment.

Stub up conduits, with bushings, 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

3.14.2 Sealing

When the installation is complete, seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals must be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.15 FIELD QUALITY CONTROL

3.15.1 Performance of Field Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.15.1.1 Low Voltage Cables, 600-Volt

Perform tests after installation of cable, splices and terminations and before terminating to equipment or splicing to existing circuits.

a. Visual and Mechanical Inspection

(1) Inspect exposed cable sections for physical damage.

(2) Verify that cable is supplied and connected in accordance with contract plans and specifications.

(3) Verify tightness of accessible bolted electrical connections.

(4) Inspect compression-applied connectors for correct cable match and indentation.

(5) Visually inspect jacket and insulation condition.

(6) Inspect for proper phase identification and arrangement.

b. Electrical Tests

(1) Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately

1000 volts dc for one minute.

(2) Perform continuity tests to insure correct cable connection.

3.15.1.2 Grounding System

a. Visual and mechanical inspection

Inspect ground system for compliance with contract plans and specifications.

b. Electrical tests

Perform ground-impedance measurements utilizing the fall-of-potential method in accordance with IEEE 81. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground resistance tester in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument must be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test. Provide site diagram indicating location of test probes with associated distances, and provide a plot of resistance vs. distance.

3.15.2 Follow-Up Verification

Upon completion of acceptance checks and tests, show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer must be given 5 working days advance notice of the dates and times of checking and testing.

.... -- End of Section --

SECTION 33 81 19

COMMUNICATIONS UTILITY POLES
10/17

PART 1 GENERAL

1.1 SUMMARY

Section includes galvanized steel monopole with concrete foundation. Monopole to be 120 feet in height, located as per drawings. Pole to support communications and remote video surveillance system (RVSS) equipment and include platform, climbing ladder or apparatus, safety devices, grounding system and electrical power to the top of the pole.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 301	(2016) Specifications for Structural Concrete
ACI 318	(2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-10	(2010; Errata 2011; Supp 1 2013) Minimum Design Loads for Buildings and Other Structures

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A325	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A36/A36M	(2014) Standard Specification for Carbon Structural Steel

ASTM A394	(2015) Standard Specification for Steel Transmission Tower Bolts, Zinc-Coated and Bare
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A572/A572M	(2015) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A615/A615M	(2016) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A780/A780M	(2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A992/A992M	(2011; R 2015) Standard Specification for Structural Steel Shapes
ASTM C143/C143M	(2015a) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2018) Standard Specification for Portland Cement
ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C31/C31M	(2018a) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2018) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94/C94M	(2017a) Standard Specification for Ready-Mixed Concrete

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2014) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10;

	TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14) National Electrical Code
NFPA 780	(2017) Standard for the Installation of Lightning Protection Systems

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-222	(2005G; Add 1 2007; Add 2 2009; Add 3 2014; Add 4 2014; R 2014; R 2016) Structural Standards for Steel Antenna Towers and Antenna Supporting Structures

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA-STD-019	(2005; Rev E) Lightning and Surge Protection, Grounding, Bonding, and Shielding Requirements for Facilities and Electronics Equipment
FAA AC 70/7460-1	(2015; Rev L) Obstruction Marking and Lighting

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

14 CFR 77	Safe, Efficient Use, and Preservation of the Navigable Airspace
29 CFR 1910.23	Guarding Floor and Wall Openings and Holes
29 CFR 1910.27	Fixed Ladders
47 CFR 17	Construction, Marking, and Lighting of Antenna Structures

1.3 SYSTEM DESCRIPTION

1.3.1 Monopole Tower System

1.3.1.1 General

Work includes materials, accessories and components as required for fabrication and installation of a galvanized steel monopole tower to a reinforced concrete foundation complete with platform, climbing ladder or step bolts, fall protection provisions, safety devices, electrical power and grounding system.

Communications and surveillance equipment are not included in this project.

1.3.1.2 Design

Except as modified herein, the pole tower shall be designed and installed in accordance with TIA-222 and other applicable standards, codes, and regulations.

1.3.1.3 Structural Design

Tower superstructures shall be designed for worst-case structural loading conditions including support for known equipment with capacity for

additional, future equipment loads equal to 50% of the pole tower strength in the controlling element using a commercially acceptable modeling program. Pole tower foundations and anchoring systems shall be designed to support the maximum structural limits for known equipment and future equipment loads of the pole tower superstructures.

Additional structural design criteria include:

a. Pole tower shall be able to meet serviceability requirements on twist, sway, and deflection for all microwave emitters and antenna dishes attached to the pole tower. When transmission frequencies are not identified, the contractor shall use 8 Ghz for a 3dB degradation to assess the operational capacity of all microwave emitters.

b. Pole tower shall be designed as a Risk Category III and IV structure.

c. Equipment cabinet to be located on the pole tower platform at an elevation of 118-feet above finished foundation grade.

1.3.1.4 Structural Loading

Refer to drawings for pole tower structural loading values required for structural design. Design static and dynamic loads shall be in compliance with IBC requirements.

1.3.1.5 Tower Configuration

Pole tower design configuration should include the following:

a. Pole tower to be of galvanized structural steel self-supporting to height shown on drawings.

b. Provide pole tower climbing apparatus complete with galvanized ladder with steel rails, rungs, step bolts, brackets, resting platforms, personal fall arrest system (PFAS) anchorage points in compliance with OSHA regulations.

c. Pole tower climbing ladder shall contain a security mechanism or gate preventing access to the climbing apparatus. The mechanism or gate shall be of galvanized steel construction with closing hardware capable of receiving a padlock for security purposes.

d. Provide manufactured galvanized steel platform with guardrail, toe-bars, safety bars, intermediate rails, and/or chains in compliance with TIA-222, section 12 requirements (Class A systems for inexperienced climbers) and OSHA 29 CFR 1910.23 and 29 CFR 1910.27. Platform to be a minimum of 10 feet by 10 feet in size with one side facing the international border. The toe-board shall be continuous at the perimeter of the platform and a minimum of 4-inches in height above the top of the platform. Secure platform to pole tower with structural connections and safety apparatus to prevent collapse of platform. Include a maintenance access port in the platform floor allowing for access to platform from the climbing apparatus. The access port shall be secured by a galvanized steel hatch door with tamper proof zinc-plated hinges, automatic hold-open arm, and locking hardware including handles and padlock hasps.

e. Erection apparatus including jib crane, hoist, and gin pole.

1.3.1.6 Electrical Power

Provide 4,000 watts of electrical power to the top platform. All electrical work to comply with NFPA 70.

a. Provide electrical disconnect switch(es) at pole tower base mounted to a non-metallic structure.

b. All rigid conduit to be mounted to the pole tower structure from pole tower base to termination points.

c. Provide 4 separate 20A electrical circuits in appropriately-sized junction boxes mounted at the appropriate locations for equipment on the platform. Provide dedicated electrical circuits: 2 each for RVSSU; 1 each for Utility; 1 each for Others.

1.3.1.7 Communications

Provide 10 pair multi-mode fiber optic cable with connector type ST with capacity of 100 Mb for RVSSU, fiber routed to the platform for RVSS equipment connection.

1.3.1.8 Grounding

Pole tower to be equipped with grounding system in compliance with TIA-222, NFPA 780, and FAA-STD-019 requirements.

a. Provide subsurface grounding ring in compliance with FAA-19E. Provide 3 stub-up connections at pole tower base for lightning protection connection.

b. Provide supporting documentation showing ground resistivity before and after installation and that the resistivity is equal to or lower than the TIA-222 requirement.

c. Provide minimum of two connection points of wall grounding to subsurface grounding ring.

d. Provide UL-listed NFPA 780 Class II or coarser air terminals mounted at the top of the pole tower projecting a minimumdetermined by the NFPA 780 rolling sphere model above the top of the tower and any appurtenances and equipment. When multiple air terminals are required to meet lightning zone of protection requirements, these air terminals shall be bonded together via a halo conductor ring (perimeter loop) that encircles the pole tower. The halo ring shall be UL-listed NFPA 780 Class II or coarser lightning protection conductor cable. Air terminals shall be provided the full height of the tower to provide a zone of protection using either the Fixed Angle methodology or the NFPA 780 Rolling Sphere Method.

1.3.1.9 Electrical Enclosures

Comply with requirements in NEMA 250 for electrical equipment enclosures for equipment and electrical devices.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When

used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Pole Tower Erection Plan

SD-02 Shop Drawings

Foundation Reinforcing Steel

Monopole Tower Installation Details

Foundation Anchorage Bolts And Embedded Items

Monopole Tower Structural Shop Drawings

SD-03 Product Data

Monopole Tower

Structural Steel Plates, Shapes, And Bars

Climbing System Components

Gate

Hatch

Electrical Components

Lightning Protection System Components

SD-05 Design Data

Concrete Mix Design

Structural Design Criteria Calculations

SD-06 Test Reports

Concrete Mix Design

Concrete Compressive Strength Tests

Concrete Slump Tests

SD-07 Certificates

Manufacturer's Qualifications Statement

Installer's Qualifications Statement

SD-08 Manufacturer's Instructions

Manufacturer's Instructions For Installation

SD-10 Operation and Maintenance Data

Maintenance Instructions

SD-11 Closeout Submittals

As-Built Record Drawings And Calculations

1.5 QUALITY ASSURANCE

1.5.1 Qualifications

1.5.1.1 Manufacturers

Provide project descriptions and references of a minimum of 4 similar installations where manufacturer's equipment and hardware has been in operation for not less than 3 years. For references, provide names, addresses, and telephone numbers of individuals responsible for oversight of the installations. Compile material into a manufacturer's qualifications statement.

1.5.1.2 Installers

Provide project descriptions and references of a minimum of 4 similar projects where installer erected gates. Include in descriptions, names of crews responsible for the erection of gates. For references, provide names, addresses, and telephone numbers of individuals responsible for oversight of the gate installation. Compile material into an installer's qualifications statement.

1.5.2 Pre-Installation Meeting

After required submittals are approved, and at least 10 days before commencing pole tower foundations and pole installation, conduct a pre-installation meeting on site. Notify Contracting Officer of the meeting a minimum of 7 days prior to conducting the meeting. The meeting shall include contractor project superintendent, site safety personnel, installation personnel and facility user representatives.

1.5.3 Regulatory Requirements

Comply with applicable regulations and requirements of municipal, county, state, and federal agencies and authorities including, but not limited to, U.S. Customs and Border Patrol and the International Boundary and Water Commission (IBWC). Design and installation shall comply with TIA-222, ASCE 7-10, ICC IBC, ACI 318, FAA-STD-019, and CBP OTIA Guides.

1.5.3.1 FAA Determination Notice

File a Notice for determination from the FAA of the pole tower's compliance with 14 CFR 77 Objects Affecting Navigable Airspace using Form FAA 7460-1.

1.5.4 Shop Drawings and Calculations

Structural design calculations and pole tower fabrication and installation shop drawings shall be prepared and sealed by a registered professional engineer licensed in the state in which the pole tower is located. Each set of shop drawings is to include the following as a minimum:

a. Monopole tower structural design criteria calculations and for its

foundation.

b. Site plan drawn to a minimum scale of 1/8 inch per foot illustrating location of monopole tower foundation and tower in relation to surrounding appurtenances and construction.

c. Foundation design drawings including plan and section views at a minimum scale of 1/2 inch per foot illustrating locations, sizes, amounts of foundation reinforcing steel, details of foundation anchorage bolts and embedded items, and dimensions and extent of the foundation.

d. Monopole Tower and monopole tower structural shop drawings illustrating cross-section profile, materials, material thicknesses, splice locations and methods, plate sizes and locations, required welds, climbing system components, gate installation, hatch installation, platform connection, platform size and components. Include monopole tower installation details and structural steel plates, shapes, and bars.

e. Pole tower erection plan and drawings.

f. Monopole tower electrical components, raceways, boxes, connections, wiring, materials. Include lighting system and componentry if required.

g. Monopole tower grounding and lightning protection system components and design, calculations, and details.

1.5.5 Manufacturer's Instructions

Comply with written manufacturer's instructions for installation of monopole tower, components, and systems.

1.6 PROJECT/SITE CONDITIONS

Field verify site conditions and locations of existing utilities affecting pole tower locations. If undocumented utilities are discovered, notify COR prior to initiating gate construction.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Steel

2.1.1.1 Structural Steel

a. Medium steel: ASTM A36/A36M

b. High-strength steel: ASTM A572/A572M, Grade 65

2.1.1.2 Fasteners

a. Bolts: ASTM A325 or ASTM A394 (Type 1 or 2)

b. Nuts: ASTM A563-grade, style, and size suitable for bolts

2.1.1.3 Monopole and Supports

ASTM A992/A992M; ASTM A36/A36M; and/or ASTM A572/A572M

2.1.1.4 Welding Requirements

Per AWS D1.1/D1.1M

2.1.2 Reinforced Concrete

2.1.2.1 Formwork

Comply with ACI 301 Section 2.

2.1.2.2 Steel Reinforcement

a. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed

b. Bar Supports: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars in place. Supports to be of steel wire, or plastic.

2.1.2.3 Cementitious Materials

Portland Cement: ASTM C150/C150M, Type II or Type V.

2.1.2.4 Water

Potable

2.1.2.5 Ready-Mix Concrete

Per ASTM C94/C94M for concrete mix design.

a. Normal-weight, aggregate size of 3/4-inch nominal per ASTM C33/C33M.

b. Compressive strength (f'c): 3000 psi at 28 days

c. Slump: 4-inches maximum

2.2 FINISHES

2.2.1 Steel Members Hot-Dip Galvanizing

2.2.1.1 Removal

Remove all welding slag, splatter, anti-splatter compounds and burrs prior to galvanizing. Remove grease, oil, paint and any other contaminants that would hinder or impede galvanizing process.

2.2.1.2 Handling of Material

Provide holes and/or lifting lugs to allow for handling of material during galvanizing.

2.2.1.3 Hot-dip Galvanizing

Galvanize steel members, fabrications and assemblies after fabrication by the hot-dip galvanizing process in accordance with ASTM A123/A123M.

2.2.1.4 Hardware Components

Galvanize bolts, nuts, washers and iron and steel hardware components in accordance with ASTM A153/A153M.

2.2.1.5 Surface Finish

Continuous, adherent, as smooth and evenly distributed as possible, free from defects.

PART 3 EXECUTION

3.1 EXAMINATION

Prior to pole tower installation, verify with Contracting Officer to verify if CBP will require tower lighting.

3.1.1 Lighting

If lighting is required, provide lighting system in compliance with 14 CFR 77, 47 CFR 17, and FAA AC 70/7460-1. The lighting system shall include appropriate remote failure notification systems to support notification of system failure to the appropriate FAA flight service station. If requested, a self-powered or wired visible or IR obstruction light shall be provided at the top of each tower to support nearby air operations. Tower lighting that extends away from the pole tower shall be on a hinged swing arm, retractable arm, or similar device to support safely servicing lighting.

3.1.2 Compliance with Requirements

Examine substrates, areas and conditions, with pole tower erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

3.2 PREPARATION

Provide temporary shores, guys, braces, and other supports during erection to maintain pole tower secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when final erection and installation is completed.

3.2.1 Foundations

3.2.1.1 Excavate Foundations

Excavate foundations to size and configuration as indicated on drawings or approved shop drawings.

3.2.1.2 Concrete Reinforcing Steel

Install concrete reinforcing steel in accordance with section 03 20 00.00 10 CONCRETE REINFORCING.

3.2.1.3 Place Concrete

Place concrete in accordance with section 03 30 00 CAST-IN-PLACE CONCRETE.

3.3 ERECTION

Erect pole tower according to the approved erection plan and in accordance with manufacturer's written instructions and drawings.

3.3.1 Base and Bearing Plates

Clean concrete-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of bearing plates.

3.3.2 Support Members

Align and adjust framing and pole tower support members before permanently fastening. Level and plumb structural support members as necessary.

3.4 INSTALLATION

3.4.1 Pole Tower Components

Install pole tower components for climbing, platform, and safety devices in accordance with approved shop drawings and per the erection plan.

3.4.2 Electrical

Install electrical raceways and boxes, grounding system including grounding ring, and lighting system if to be provided.

3.5 FIELD QUALITY CONTROL

3.5.1 Testing

Upon completion of pole tower erection and installation of equipment, test operation of performance. Test should be witnessed by COR, CBP representative, and other facility personnel responsible for operation of tower systems and acceptance. Provide minimum 72 hours of notice to COR prior to conducting test. The test shall include all systems and components of the pole tower assembly to ensure complete systems performance check. Document test procedures and results in a written summary report.

3.5.2 Field Welding

Ensure welding procedures comply with AWS D1.1/D1.1M.

3.5.3 Concrete Tests

Test concrete samples according to ASTM C172/C172M.

3.5.3.1 Testing Frequency

Obtain minimum of one composite sample for each 100 cubic yards or fraction thereof.

3.5.3.2 Concrete Slump Tests

One test at point of placement, but not less than one test for each day's pour. Test according to ASTM C143/C143M.

3.5.3.3 Compression Test Specimens

Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample per ASTM C31/C31M.

3.5.3.4 Concrete Compressive Strength Tests

ASTM C39/C39M, test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

3.6 CLEANING AND PROTECTION

Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to manufacturer's written instructions or per ASTM A780/A780M.

3.6.1 Touch Up Painting

Immediately after installation, clean field welds, bolted connections, abraded areas, and exposed areas of painted surfaces with same paint material used for shop painting to match adjacent surfaces. Apply paint by brush or spray to provide a minimum dry-film thickness of 2.0 mils.

3.6.2 Maintenance Instructions

Provide bound copy of manufacturer's written maintenance instructions for pole and hatch, as well as other systems at conclusion of installation or construction.

3.7 CLOSEOUT ACTIVITIES

3.7.1 As-Built Record Drawings and Calculations

Maintain and keep current, a separate set of drawings, diagrams, and final design calculations to be used for record drawings, showing all changes and additions to the pole tower and componentry including electrical, lighting, and lightning protection systems. Submit as-built record drawings and calculations in accordance with section 01 78 00 CLOSEOUT SUBMITTALS.

-- End of Section --

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APPENDIX D – NOT USED

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APPENDIX E – DRAINAGE REPORT

LOWER RIO GRANDE VALLEY
FROM FALCON DAM
TO HIDALGO-CAMERON COUNTY LINE

PROGRAMMATIC FLOODPLAIN ANALYSIS AND REPORT

The Rio Grande Valley Texas
Contract Number W9126G-15-D-0009

May 15, 2018

Registered Professional Engineer (Civil)
CERTIFICATE NO
53023
ALEJANDRO
RIANO
5/15/18
DATE SIGNED
ARIZONA, U.S.A.
Exp. 12/31/20

5/15/18

STATE of TEXAS
AZEEZ JOHN SALIBA
130194
LICENSED
PROFESSIONAL ENGINEER

Prepared for:
Department of Army
Fort Worth District
Corps of Engineers
Fort Worth, Texas

Prepared by:
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Michael Baker
INTERNATIONAL

FINAL
LOWER RIO GRANDE: FALCON DAM TO HIDALGO COUNTY LINE PROGRAMMATIC FLOODPLAIN ANALYSIS AND REPORT

The Rio Grande Valley, Texas

Contract Number W9126G-15-D-0009

Prepared for:

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15 May 2018

FIGURES

ATTACHMENTS	TITLE
A	Figures
B	Hydraulics Documentation
C	Construction Documents
D	USIBWC Coordination and Documentation

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TABLE OF CONTENTS

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TABLES

1.0 SECTION 1: PROJECT DESCRIPTION AND SUMMARY

1.1.0 INTRODUCTION/PURPOSE

Michael Baker International (Michael Baker) has prepared this Draft Final Programmatic Drainage Report for the United States Army Corps of Engineers (USACE) – Fort Worth District, Engineering and Construction Support Office (ECSO) in support of the United States (US) Customs and Border Protection (CBP) Border Patrol Air and Marine Program Management Office (BPAM-PMO) relative to their Tactical Infrastructure (TI) on the Southern International Border (Border).

The purpose of this Programmatic Drainage Report is to assess the impacts of the proposed wall projects and to ensure that the US Section of the International Boundary and Water Commission (USIBWC) criteria can be met. Those criteria state that the design flood Water Surface Elevations (WSE), in proposed conditions, shall not increase more than 6-inches in rural areas or 3-inches in urban areas when compared to the existing floodplain conditions (existing condition with no wall) and have no more than a 5% increase in flow deflection. FEMA Criteria identified in Title 44, Code of Federal Regulations, Part 65, Subpart 10 (44 CFR 65.10) identifies requirements such as freeboard criteria, structural design of the wall and foundation, and an Operations and Maintenance Plan.

This report contains a floodplain analysis of the Rio Grande along the following project wall segments, with the wall lengths indicated in miles: RGV-01 (2.9), RGV-02 (7.9), RGV-03 (10.8), RGV-04 (11.2), and RGV-63 (63). These wall segments are located along the International Boundary between Texas and Mexico (MX), north of the Rio Grande floodplain.

This report has been divided into 4 sections:

Section 1: Provides an overall description of the project purpose and details.

Section 2: Provides specific details on the 1-Dimensional (1-D) model analysis for the reach between the City of Penitas (Penitas) and Hidalgo-Cameron County border, for the levee area analysis.

Section 3: Provides specific details associated with the 2-Dimensional (2-D) model analysis for the reach between Falcon Dam and Penitas, for the non-levee areas.

Section 4: Combines all the references presented in this report.

This report also accompanies the Rio Grande Valley (RGV) Sector report submittals for RGV-01, RGV-02, RGV-03, RGV-04, and RGV-63 (which has some overlap with RGV-03).

1.2.0 LOCATION

The project is located on the Border along the RGV in Starr and Hidalgo Counties, Texas, and falls within the following limits (from west to east). As shown in Figure A1 (Vicinity Map) in Attachment A:

- RGV-03 spans from the eastern boundary of Fronton Island to Mission, Texas, and extends along USBP Zones 1 and 2 (which overlap RGV-63), and USBP Zones 6 and 8.
- RGV-04 spans from South Conway Avenue in Mission, Texas to South Stewart Road in Pharr, Texas, and extends along USBP Zones 9, 10, and 11.
- RGV-01 spans across the Santa Ana National Wildlife Refuge in Alamo, Texas, and is within USBP Zone 11.

- RGV-02 spans from the east boundary of the Santa Ana National Wildlife Refuge to the south boundary of the Mercedes District Settling Basin near Progreso, Texas; it extends along USBP Zones 11, 12, and 13.
- RGV-63 spans from the outlet of Falcon Dam to Penitas, along USBP Zones 1 through 5.

Table 1: Eastern and Western Project Wall Limits

Wall	Wall Miles		Latitude	Longitude	Station Area of Responsibility
RGV-03	10.8	Western Limit	26°24'36.47"N	99°02'49.84"W	Rio Grande City and McAllen
	(1.66 Miles included in RGV- 63)	Eastern Limit	26°10'05.10"N	98°20'02.95"W	Rio Grande City and McAllen
RGV-04	11.2	Western Limit	26°10'05.10"N	98°20'02.95"W	McAllen and Weslaco
		Eastern Limit	26°04'57.40"N	98°10'08.42"W	McAllen and Weslaco
RGV-01	2.9	Western Limit	26°04'57.40"N	98°10'08.42"W	Weslaco
		Eastern Limit	26°04'36.54"N	98°07'27.75"W	Weslaco
RGV-02	7.9	Western Limit	26°04'36.54"N	98°07'27.75"W	Weslaco
		Eastern Limit	26°04'17.06"N	97°53'29.37"W	Weslaco
	TOTAL = 32.8				
RGV-63	*63*	Western Limit	26°24'38.40"N	99°02'43.82"W	Falcon Dam
		Eastern Limit	26°17'38.80"N	98°41'36.09"W	

Thirty miles of floodwalls are proposed along the levees in the RGV reach between Penitas and the Hidalgo County border, and a bollard wall is proposed in the reach between the Falcon Dam and Penitas. This report documents the impacts to the Rio Grande floodplain due to the proposed construction. The location of each proposed project segment shown in Table 1 can be seen in Figure A2 in Attachment A. The floodplain analysis for the two western segments was submitted by Michael Baker in 2011 and approved by USIBWC as part of the *PF225 Phase II Drainage Report Fence Segments O1, O2, O3* (Reference 1).

1.3.0 SITE DESCRIPTION

The proposed floodwall is to be located along the US side of the Rio Grande within the existing earthen levee cross-section. The Rio Grande within an approximately 13,500-foot (ft) wide floodplain, and flows from the western to the eastern coast at an overall 0.15% slope. The levees line both sides of the floodplain in most places, but no levees are present within Starr County. Bollard wall is proposed to be installed in the non-levee area within Starr County. The highly vegetated floodplain on the north side of the river thalweg is wide and fairly flat, consisting of agricultural land and former meanders of the river. The land north of the existing levees on the US side of the river is mostly agricultural with some rural development. Eight international bridges cross the Rio Grande, and two inline weirs are located within the study area.

Two lengths of the Rio Grande are included in this study, divided at Penitas. The first length of the Rio Grande extends downstream approximately 74 river miles from Penitas to the Hidalgo-Cameron County border. The second length is upstream of the first length, from Falcon Dam to Penitas.

1.4.0 FEMA FLOODPLAINS

The proposed wall alignment lay within sixteen Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) panels in Texas. Table 2 below shows the FIRM panels.

Table 2: FEMA FIRM Panels by County in Texas

County	Panel	Effective Date	Zone	Wall Segment	Figure
Starr	48427C0350C	April 19, 2010	**A, X**	RGV- 63	A3-1
Starr	48427C0375C	April 19, 2010	**A, X**	RGV- 63	A3-2
Starr	48427C0525C	April 19, 2010	**A, X**	RGV- 63	A3-3
Starr	48427C0520C	April 19, 2010	**A, X**	RGV- 63	A3-4
Starr	48427C0540C	April 19, 2010	**A, X**	RGV- 63	A3-5
Starr	48427C0550C	April 19, 2010	**A, X**	RGV- 63	A3-6
Starr	48427C0675C	April 19, 2010	**A, X**	RGV- 63	A3-7
Starr	48427C0680C	April 19, 2010	**A, X**	RGV- 63	A3-8
Starr	48427C0565C	April 19, 2010	**A, X**	RGV- 63	A3-9
Starr	48427C0685C	April 19, 2010	**A, X**	RGV- 63	A3-10
Starr	48427C0725C	April 19, 2010	**A, X**	RGV- 63	A3-11
Starr	48427C0750C	April 19, 2010	**A**	RGV- 63	A3-12
Hidalgo	4803340375B	January 2, 1981	**A23**	RGV-03	A3-2
Hidalgo	4803340400C	November 16, 1982	**A, B**	RGV-03, RGV-04	A3-3
Hidalgo	4803340475B	January 2, 1981	**A, B, C**	RGV-04	A3-4
Hidalgo	4803340500B	January 2, 1981	**A, B, C**	RGV-01, RGV-02, RGV-03, RGV-04	A3-5
Hidalgo	4803340525B	January 2, 1981	**A, B, C**	RGV-02	A3-6

The Starr County FIRM panels (References 2-13) show that the proposed wall is located within the Special Flood Hazard Areas (SFHAs) Zone A and Zone X.

- Zone A is described as “no base flood elevations determined,” and
- Zone X is defined as “areas determined to be outside the 0.2% annual chance floodplain.”

The Hidalgo County FIRM panels (References 14-18) show that the proposed wall is located within the SFHA Zones A23, A, B and C.

- Zone A23 is described as “areas of 100-year flood where base flood elevations and flood hazard factors are determined.”

- Zone A is described as "areas of the 100-year flood where base flood elevations and flood hazard factors are not determined."
- Zone B is described as, "areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) ft or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood."
- Zone C is described as "areas of minimal flooding."

See Figures A3-1 through A3-12 for FEMA FIRM panels in Attachment A.

1.5.0 PROPOSED IMPROVEMENTS

The proposed improvements consist of constructing a 32.8-mile long floodwall which will be placed within the existing levee cross section. The floodwall alignment will fall between the toe and top of the levee on the river side. The top of the floodwall will extend upward for at least 24-ft, with the top of the wall being at 1% slope from the crest of the existing levee providing an area for a 24-foot maintenance road at the crest of the levee. The existing levee embankment on the river side of the levee will be cut and regraded as shown in Figure 1. The top of the floodwall will be set higher than the design WSE by 3-ft to provide freeboard. A bollard wall or lights/camera poles will be set atop the floodwall. The 75-ft enforcement zone shown below is proposed for RGV-01, but a maximum 150-ft enforcement zone is proposed for the remaining projects, allowing the patrol road centerline to shift within the zone. The final construction documents are included in Attachment C. Correspondence with USIBWC, regarding the proposed wall height dated August 10, 2017, is available upon request.

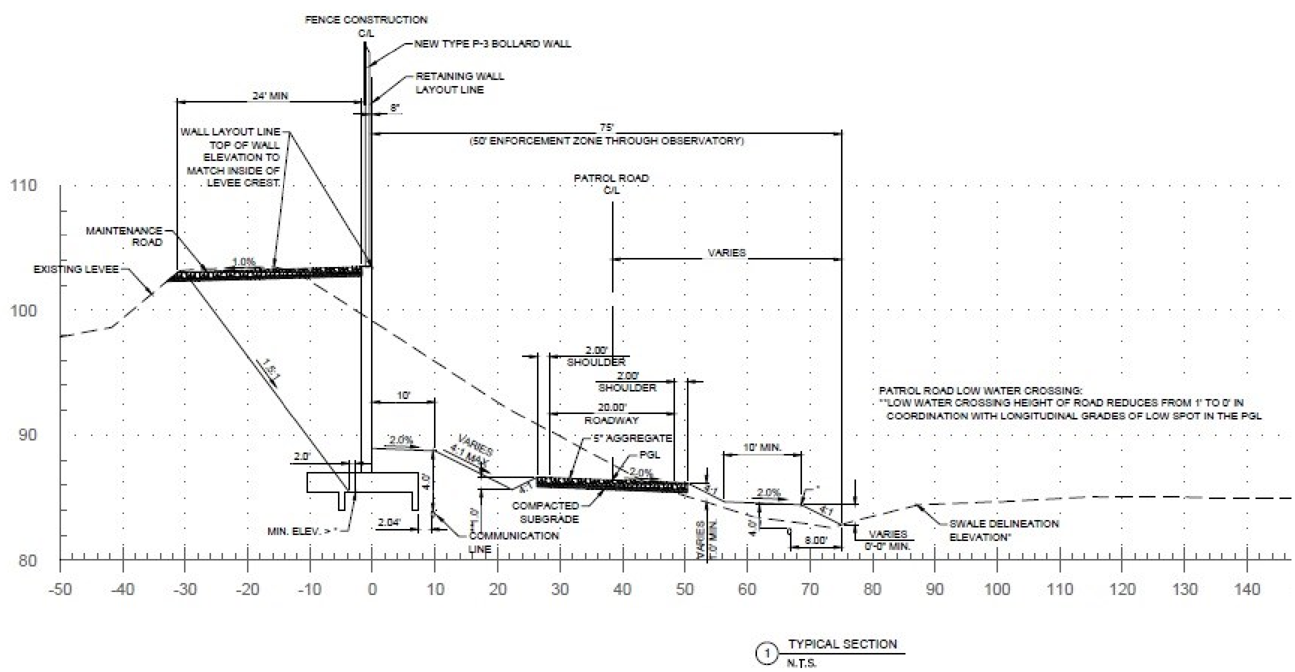

Figure 1: Cross Section of Proposed Levee and Wall

The floodwall is not proposed along the entire Rio Grande length; and is not proposed within Starr County. In addition, the two western segments of RGV-03, shown in Figure A2 (Attachment A) and within the aforementioned limits, were removed at CBP's request; therefore, they were not analyzed herein.

Within Starr County, no levee exists, so only a bollard wall is proposed. A type P-3 bollard wall with an anti-climb plate is proposed for the 63-mile non-levee reaach. The bollard wall consists of a typical configuration of 6-inch square steel bollards set on the diagonal with a 4-inch clearance between bollards or rotated steel bollards at 45-degrees with 5-inch clearance. The obstruction factor due to debris is evaluated using an obstruction factor of 35%. More details about the proposed conditions is discussed in Section 3.3.9 Proposed Wall Modeling.

Section 2 and Section 3 of this report discuss the details of the 1-D and 2-D models, respectively.

1.6.0 PROPOSED DRAINAGE CONDITION

The proposed drainage condition consists of the replacement of the levee with a floodwall and the modification to the floodplain ground elevations, due to requirements in the enforcement zones (as explained in Section 1.5.0). This proposed drainage condition will not result in impacts to deflection greater than 5% nor will it increase WSEs in excess of 6-inch in rural areas or 3-inches in urban areas. In some locations identified within the 1-D model (cross-sections 180.32, 178.5, 177.7, 174.2, 171.8, 171.15, 170.26, and 169.9), the original USIBWC condition modeling demonstrated that the levee did not meet the 3-ft of freeboard requirement. These locations are being re-evaluated and the height of the levee will be increased to meet the 3-ft freeboard requirement within those areas.

1.7.0 USIBWC COORDINATION AND DESIGN STANDARDS

All drainage analyses and designs are in compliance with the requirements of the Department of Homeland Security's TI Design Standards (Reference 19), and were agreed upon between Michael Baker and the USIBWC during the first technical meeting on June 28th, 2017, and a conference call held on July 13th 2017. These meetings and documents covered project specific details, including calculation methodologies, water surface increase thresholds of 3-inches in urban and 6-inches in rural areas, and the 5% increase of allowable deflection. USIBWC coordination and drainage excerpts of the TI Design Standards are provided in Attachment D. Meeting minutes can be provided upon request.

1.8.0 HYDROLOGIC AND HYDRAULIC ANALYSES

The existing design storm discharges, obtained from USIBWC, were utilized for hydraulic modeling. Hydrologic Engineering Center River Analysis System (HEC-RAS) Version 5.0.3 (Reference 20) was used for all hydraulic modeling procedures. Two independent hydraulic models were built for the different reaches of the river:

- A 1-D model for the reach between Penitas and the Hidalgo County line was used to evaluate impacts in the levee areas (described in Section 2).
- A 2-D model for the reach between Falcon Dam and Hidalgo County was used to evaluate impacts of the bollard wall in the Rio Grande floodplain (described in Section 3).

1.9.0 CONCLUSIONS

The proposed bollard wall between Falcon Dam and Penitas meets USIBWC criteria. The proposed levee wall between Penitas and Hidalgo-Cameron County Line, within the project parameters, will be designed such that 44 CFR 65.10 requirements will be met. This includes freeboard criteria, structural design of the wall and foundation, and an Operations and Maintenance Plan. In addition, both the floodwall design between Penitas and Hidalgo-Cameron County Line and the bollard wall segment between Falcon Dam and Penitas will not impact the existing Base Flood Elevations or floodplain limits identified on the FEMA FRIM panels. USIBWC deflection criteria is also met and demonstrated by both the 1-D and 2-D floodplain analysis.

2.0 SECTION 2: 1-D MODELING WITH LEVEE AREAS, PENITAS TO HIDALGO COUNTY

2.1.0 INTRODUCTION

The following section outlines the procedures implemented for the impact analysis of the 32-miles of proposed floodwall along the Rio Grande from Penitas to the Hidalgo-Cameron County Boundary in Texas.

2.2.0 HYDROLOGIC ANALYSIS

The discharge rates provided in Table 3 were applied at the following locations in the hydraulic model:

Table 3: USIBWC Applied Discharge Rates

HEC-RAS River Name	HEC-RAS Reach Name	Cross-Section River Miles	USIBWC Provided Peak Discharge (cfs)
River-1/Rio Grande	Reach-1/Lower	274.2	240,000
River-1/Rio Grande	Reach-1/Lower	186	235,000
River-1/Rio Grande	Reach-1/Lower	169.83	130,000
River-1/Rio Grande	Reach-1/Lower	156.93	125,000
River-1/Rio Grande	Reach-1/Lower	129.3	20,000

Table note: cfs – Cubic Feet per Second

According to the effective Flood Insurance Study (FIS), the discharge values are based on the historic peak flooding from the September 1988 flood (Hurricane Gilbert) at Rio Grande City, located downstream from the Rio San Juan and Rio Grande Confluence. Rio Grande is regulated by international treaties between the US and Mexico and the floodplain in the US is administered by USIBWC.

2.3.0 HYDRAULIC ANALYSES

HEC-RAS Version 5.0.3 (Reference 20) was used for all hydraulic modeling procedures. Two independent hydraulic models for the proposed 32 miles of floodwall were built for the different reaches of the river; a 1-D HEC-RAS model, and a “LowerRioGrande.prj” model, which contains a duplicate effective plan, a corrected effective plan, and a proposed plan that were generated using a USIBWC-approved model called “lrg2003NAVD88.prj”. See Table

4: HEC-RAS Model LowerRioGrande Summary Table of Plans and Files for descriptions of the plans and associated flow, geometry, and hydraulic design files.

Table 4: HEC-RAS Model LowerRioGrande Summary Table of Plans and Files

Project Name	Plan Name	USIBWC File Names	New File Names
LowerRioGrande.prj	Duplicate Effective (LowerRioGrande.p02)	*Geometry:*	*Geometry:*
		LRGFCP UPDATED BRIDGES MARCH 2007.g04	Duplicate Effective (LowerRioGrande.g04)
		Steady Flow:	*Steady Flow:*
		LRGFCP DIVERSION FLOOD - MIN. 238.f01	Duplicate Effective Flow (LowerRioGrande.f02)
		Hydr Design:	*Hydr Design:*
		LRG UPDATED BRIDGE MARCH 2007.h01	Duplicate Effective (LowerRioGrande.h01)
Description: The River and Reach names were changed to Rio Grande, Lower Reach, respectively, by Michael Baker. March 2007 AN ADDITIONAL 70 cross sections THAT WERE SURVEYED in MARCH 2007 WERE ADDED TO THE IBWC'S 2003 HECRAS BACKWATER MODEL. THE EARLIER 2003 MODEL'S GEOMETRY WAS CONVERTED FROM 1929 DATUM TO CURRENT NAVD 88 DATUM. THIS MODEL WAS PREPARED USING HEC-RAS VERSION 4.0. THE FINAL PLAN MODEL ADDRESSED ASBUILT CHANGES TO THE 2003 MODEL'S BRIDGES AT HIDALGO REYNOSA AND PROGRESO January 2003 (Earlier Model) CURRENT MAINTENANCE WITH CONTROLLED GROWTHHEC-RAS BACKWATER MODEL OF THE RIO GRANDE , FROM BELOW BROWNSVILLE TO PEÑITAS This model used HEC-RAS Version 3.1.1. Newer versions may give slightly different results. River sections generally surveyed during 1990. A few sections were surveyed earlier. This version contains 24 additional sections with respect to the 1992 model, that were surveyed in 2001. Some of the geometry data at the dams, bridges, and floodway inlets was taken from construction drawings and other sources. The flow of 235,000 cfs represents an attenuated flow from 250,000 cfs at Rio Grande City. An additional 5000 cfs attenuation in the flood peak is assumed to occur between Anzalduas Dam and Retamal Dam. Flows have been input to simulate this attenuation. Each flow diversion at the Main Floodway in the US and at the Mexican Floodway are 105,000 cfs, as agreed with MX in Minute No. 238. Starting elevation at River Mile 28 does not include storm surge or tidal effects. All elevations are referenced to Mean Sea Level Datum.			

Project Name	Plan Name	File Names
LowerRioGrande.prj	Corrected Effective (LowerRioGrande.p01)	*Geometry:*
		Corrected Effective (LowerRioGrande.g01)
		Steady Flow:
		Design Flow (LowerRioGrande.f01)
		Hydr Design:
		Duplicate Effective (LowerRioGrande.h01)

Description:
July 2017
The duplicate effective river reach and cross-sections were re-cut using the 2008 IBWC-provided surface, integrated with 2017 survey datum (at cross-sections 145-139.85, 161.4-160, and 155.2-135.5).

Reach lengths were approximated between structures based on the duplicate effective model. Then, cross-sections and cross-section configurations were approximated using USIBWC-provided hardcopy maps. Reach lengths for 169.83 and 169.49 were revised to 1300 ft, and for 167.4 and 167, were revised to 2500 ft. Applied reach lengths were imported from the GeoRAS and not copied from the duplicate effective model. The reach was also truncated at cross-section 112.2.

Cross-sections 186, 169.14, 169.12, 169.1, 156.93, 156.9, 156.87, 156.84, 151.27, 151.25, 129.23, 129.22, 129.216, 129.214, 129.213, 129.212, 129.211, 129.21, 120.62, 120.59, and 112.2; and structures at river stations at 169.13, 156.915, 156.855, 151.255, 129.215, and 120.605 were duplicated from the USIBWC 2008 model, except for 169.14 which was elevated on the left bank to match the surface elevations.

Manning's n-values, contraction and expansion coefficients, blocked obstructions, levees, and ineffective flow areas were approximated, following associated duplicate effective sections. Bathymetric stations and elevations were translated from the associated duplicate effective cross-sections by graphical interpretations.

New cross-sections were placed at the beginning and ending of the proposed wall. New cross-sections (excluding interpolated sections) include 180.32, 174, 172, 169.9, 166, 165, 163, 161.35, 161.3, 160, 159, 157.2, 155.2, 145.5, 145.2, 144.7, 144, 143.5, 143, 142, 141.5, 136.8, 136.2, 136, and 135.5. Cross-sections 155.01, 154.6, 154.23, and 153.85 were extended on the left bank to the levee. Bathymetric elevations, n-values, blocked obstructions, levees, and ineffective flow areas for these new sections were placed based on similar upstream or downstream cross-sections.

Cross-section 159.16 was removed due to conflicts with new cross-sections, and cross-sections downstream of 112.2 were eliminated.

Control System Group: United States / State Plane 1983
Zone: Texas South 4205 (GROUND)
Datum Transformation: NAD 1983 (Conus) (Molodensky)
Geoid Model: GEOID12B
Units: US Survey Feet
Vertical Datum: NAVD88.

The corrected effective and proposed flow boundary condition matches the WSE of the duplicate effective at cross-section 112.2 (72.10-ft)

2.3.1 DUPLICATE EFFECTIVE PLAN

The duplicate effective plan contains duplicate effective geometry, flow, and hydraulic design files. The duplicate effective geometry, which was not georeferenced, is part of the original USIBWC model called "lrg2003NAVD88.prj" that was received by Michael Baker on July 11, 2017 (see Attachment D for e-mail correspondence with USIBWC). The geometry extends from River Stations 186 to 28. The name of the river was changed from "River-01" to "Rio Grande," the name of the reach was changed from "Reach-01" to "Lower," and the geometry file was changed from "LRGFCP updated bridges March 2007" to "duplicate effective." The flow file was renamed to "Duplicate Effective Flow" and the hydraulic design file was changed from "LRG updated bridge March 2007" to "duplicate effective"; otherwise, all the hydraulic content of the model remains unmodified. The model was then named "LowerRioGrande.prj" using the updated HEC-RAS software.

2.3.2 CORRECTED EFFECTIVE PLAN

A corrected effective plan was generated from the duplicated effective plan to assess the proposed design along the left bank levee of the Rio Grande. In general, the corrected effective geometry was georeferenced after developing the terrain, and the river and cross-sections were placed as accurately as available data permitted. In addition, some cross-sections were added, one was deleted, and the geometry was truncated downstream of river station 112.2 at the Hidalgo Border. The geometry was built using ArcGIS 10.4.1 (Reference 21), HEC-GeoRAS 10.1 (Reference 22), and ESRI Aerial Imagery (Reference 23). Hydraulic features were then added to each section, closely matching the features of the duplicate effective model.

The terrain used for modeling is composed of 2007 and 2017 datum. The 2007 terrain surface extends from MX into the US, and was obtained from USIBWC. Bathymetry was not included. This terrain was used to build the cross-sections within the duplicate effective geometry. In July 2017, Aerotech Mapping flew a 2000-ft wide alignment along the proposed wall locations for this project. Michael Baker sewed these terrains together using ArcMap to form a cohesive surface for the model. Datum and elevations were verified to be consistent among all the surfaces received. The horizontal datum is NAD 1983, State Plane Texas South 4205-Ft, and the vertical datum is NAVD88. The survey datum has been provided in Attachment C.

After building the terrain, the geometry was georeferenced by drawing the hydraulic baseline (HEC-RAS river reach) of the Rio Grande from the Falcon Dam to the coast, using the aerial imagery in ArcMap and HEC-GeoRAS. Structures identified on the aerial imagery were matched to the structures in the USIBWC model. The reach lengths between the structures were stretched or shortened within the identified channel, and/or over the adjacent floodplain, in order to match the reach lengths found in the duplicate effective geometry. The cross-section/reach intersections were identified using the reach lengths provided in the model, before the cross-sections were placed. The cross-sections were placed left to right, looking downstream, using the Cross-Section Location Map of the *Hydraulic Model of the Rio Grande and Floodways within the Lower Rio Grande Flood Control Project* in Attachment A (prepared by USIBWC and dated June 2003 [Reference 24]), and the Cross-Section Survey and Location Map of the *HEC-RAS Hydraulic Model Update and Validation and FLO-2D Simulation for the Lower Rio Grande Flood Control Project* in Attachment C (prepared for USIBWC by S&B Infrastructure Limited, and dated July 2008 [Reference 25]). Cross-sections were not extended to contain the flow, but cross-sections 155.01, 154.6, 154.23, and 153.85 were extended to the north levee. The river reach was further manipulated between the cross-sections to match the downstream-channel reach lengths of the duplicate effective geometry.

New sections were drawn at the start and end of the new wall, if a cross-section was not already in place. Additional new sections were placed where interpolated cross-sections could not reasonably be used. These

would most often occur where tens of thousands of ft separated the USIBWC cross-sections, due to tight curvatures in the river. The left and right reach lengths were drawn roughly parallel to the river reach, about one-third the distance to the existing levees. The flow paths, river, and cross-sections with elevation and station data, were imported from HEC-GeoRAS into the HEC-RAS model. Interpolated cross-sections were introduced by using the HEC-RAS interpolation function after everything was imported and a maximum distance of 2000-ft between cross-sections was specified. All cross-sections were filtered using the cross-section points filter function within HEC-RAS, minimizing the change in area, down to 460 points.

Some features were duplicates of the original USIBWC datum, instead of features generated by the terrain. These features included the most-upstream cross-section, the most downstream cross-section, the cross-sections around the structures, and the structures which include in-line structures and bridges. Five cross-sections extended beyond the available terrain. These sections were completed with the original USIBWC cross-section datum.

Once the cross-section geometry was brought into HEC-RAS, the Manning's n-values, bank stations, levees, expansion and contraction coefficients, blocked obstructions, ineffective flow areas, and bathymetric elevations were approximated by referencing these parameters from the adjacent cross-sections of the duplicate effective geometry. In the new sections, these hydraulic parameters were placed by using the immediate upstream or downstream USIBWC cross-sections as guides.

Like the USIBWC model, n-values were applied horizontally across the cross-sections, ranging from 0.015, representing the sandy bottom of the Rio Grande, up to 0.188 for the overbank areas. Bank stations were set where changes in slope across the cross-section represented the break from channel to overbank, and at similar locations to those set by USIBWC. Levees were located along either side of most cross-sections, at the highest ground elevation. The HEC-RAS default coefficients for expansion and contraction are 0.1 and 0.3, respectively. Upstream and downstream of the structures, 0.2 and 0.5 default coefficients were applied respectively by USIBWC; these values were not modified by Michael Baker.

Blocked obstructions and ineffective flow areas were placed per the USIBWC cross-sections; below the overbank elevations in old river meanders, settling basins, or agricultural fields; approximating the original sections. Some blocked obstructions were placed to represent developed areas or settling basins set higher than the channel banks. For the new and interpolated cross-sections, these parameters were reviewed spatially and applied with reasonable consistency, reflecting no change or gradual changes between sections.

The bathymetric elevations for each cross-section were processed by applying the vertical and horizontal shifts that were evident after plotting the station and elevation data of the associated duplicate effective and corrected effective cross-sections. Some cross-sections approximated the duplicate effective cross-sections so no vertical translation was required. See Figure 2 for an example at River Station 171.8.

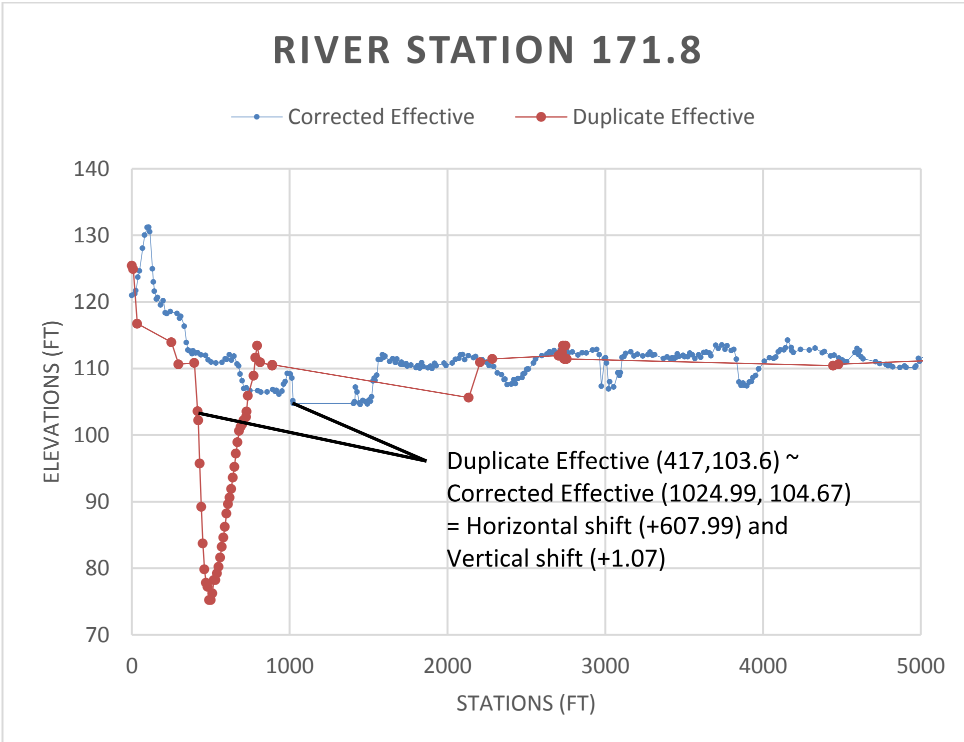

Figure 2: Graph used for Bathymetric Calculations

The design flow file applied in the corrected effective plan maintains the flow rates of the duplicate effective flow file, but the boundary condition was revised to match the WSE of the duplicate effective output at River Station 112.2, which was 72.10-ft. No revisions were made between the duplicate effective and corrected effective hydraulic design files.

2.3.3 CORRECTED EFFECTIVE AND DUPLICATE EFFECTIVE PLAN COMPARISON

After the corrected effective plan was finalized, the duplicate effective and corrected effective plans were run, and the output WSEs were compared to assess the reasonable accuracy of the changes made. See Table 5 for a comparison of the WSEs. Changes can be attributed to a combination of topographic updates, additional cross-sections, and an updated version of the HEC-RAS software.

The maximum increase from the corrected effective plan to the duplicate effective water plan's surface elevation is 2.43-ft at River Station 178.5, and the maximum decrease is 0.35-ft at River Station 153.61. The average increase is 0.63-ft. In general, the largest increases are associated with the highest discharge rate of 235,000 cfs, with an average of 1.82-ft, and the smallest discharge rate is associated with the smallest changes, with an average 0.31-ft. These differences were deemed reasonable.

Table 5: Comparison of Corrected Effective and Duplicate Effective Water Surface Elevations

Corrected Effective Water Surface Elevations - Duplicate Effective Water Surface Elevations = ∆WSE									
River Station	**∆WSE (ft)**	**River Station**	**∆WSE (ft)**	**River Station**	**∆WSE (ft)**	**River Station**	**∆WSE (ft)**	**River Station**	**∆WSE (ft)**
186	1.17	**168.85**	1.67	**153.61**	-0.35	**137.14**	0.10	**125.3**	0.31
185	1.22	**168.58**	1.12	**153.36**	-0.34	**135**	0.17	**125**	0.32
184	1.09	**168.3**	1.15	**152.53**	-0.20	**134.65**	0.13	**124.4**	0.08
183.2	1.50	**168**	0.32	**151.7**	0.15	**132.75**	0.38	**123.8**	0.09
182.4	1.77	**167.4**	0.12	**151.49**	0.11	**131.6**	0.37	**123.15**	0.07
181.35	1.78	**167**	-0.07	**151.27**	0.03	**131.35**	0.30	**122.5**	0.09
180.3	2.07	**166.6**	-0.14	**151.25**	0.03	**130.93**	0.50	**121.46**	0.13
179.4	2.02	**162.1**	0.04	**151.24**	0.04	**130.51**	0.76	**120.7**	-0.06
178.5	2.43	**161.4**	-0.17	**150.78**	0.00	**129.3**	0.68	**120.62**	-0.04
177.7	2.20	**157.15**	1.02	**150.31**	0.05	**129.27**	0.68	**120.59**	-0.05
176.8	2.04	**156.93**	0.57	**149**	0.10	**129.23**	0.69	**120.5**	-0.10
175.6	1.97	**156.9**	0.55	**147.68**	0.15	**129.22**	0.70	**120.38**	-0.11
174.6	2.13	**156.87**	0.55	**146**	0.36	**129.216**	0.75	**118.81**	0.09
174.2	2.08	**156.84**	0.55	**145**	0.60	**129.214**	0.61	**117.87**	0.28
171.8	2.21	**156.7**	-0.23	**144.55**	0.72	**129.213**	0.70	**117.2**	0.24
171.15	2.17	**156.6**	0.65	**143.25**	0.54	**129.212**	0.71	**116.5**	0.22
170.5	1.14	**156.15**	0.34	**142.5**	0.21	**129.211**	0.65	**116.1**	0.18
170.26	1.84	**155.7**	0.46	**141.9**	0.36	**129.21**	0.64	**115.7**	0.25
170.02	1.83	**155.36**	0.46	**140.74**	0.53	**129.2**	0.69	**115**	0.12
169.83	2.17	**155.01**	0.77	**140**	0.68	**129.03**	0.67	**114.8**	0.25
169.49	1.24	**154.81**	1.50	**139.85**	0.71	**128.5**	0.33	**114.65**	0.26
169.14	1.37	**154.6**	1.12	**139.01**	0.78	**127.7**	0.35	**114.1**	0.27
169.12	1.29	**154.23**	0.43	**138.36**	0.48	**127.4**	0.36	**113**	0.06
169.1	1.31	**153.85**	-0.11	**137.71**	0.29	**126.7**	0.25	**112.2**	0.00

2.3.4 PROPOSED PLAN

The proposed plan includes the same design flow file as the corrected effective plan, and a proposed geometry file that is based on the corrected effective geometry. See Table 6 for projects associated with the cross-sections that were updated with the proposed geometry. The proposed 75-feet enforcement zone cross-section geometry is reflected for RGV-01; the construction documents are included in Attachment C. A 150-feet enforcement zone is currently being proposed for RGV-02, -03, and RGV-04, and therefore the cross-sections associated with each of these projects will reflect that geometry.

Table 6: Projects and Associated Cross-Sections with Proposed Geometries

Project	Cross-Sections
RGV-03	180.32 – 171.8
RGV-04	171.48 – 169.9, 161.35 and 161.3, 155.2 – 145.5
RGV-01	145.5 – 139.85
RGV-02	139.57 – 135.5, 127.7 – 124.4, 120.8 – 120.4, 117.2 – 115.2

To generate the proposed geometry, two fixed points were identified: the existing levee elevation (1) and the existing grade 150-ft (the enforcement zone) south of the proposed wall location, also known as the daylight point (2). See Figure 3 for an illustration of these points at cross-section 155.2. These points were used to calculate the slope between two unknown points, A and B. The variables used to change the values of A and B are wall height (W) and side slopes, SS_1, SS_2, and SS_3.

The levee elevation in the cross-section (1) was identified and extended upward at 1% toward the river for 24-ft to represent the top of the wall. A 10-ft drop in elevation, at the same location, represents a 10-ft wall. From the bottom of the wall, a 2% slope away from the wall for 10-ft was used to calculate the elevation at point A.

From the daylight point (2), the adjacent SS_1 was initially set at 4:1 for 6-ft to accommodate a low water crossing. From that point, the slope extends up 10-ft at 2%. From here, SS_2 extends up initially at 4:1 for 6-ft to meet the first edge of the compacted subgrade. The roadway is sloped 2% for 24-ft. From there, the grade slopes down for 3-ft, initially at 4:1 SS_3 to point B.

W, SS_1, SS_2, and SS_3 (all side slopes, adjusted to be the same for modeling simplicity,) were adjusted to calculate the slope between points A and B. The slope was set to allow drainage to fall away from the wall at no more than a 4:1 slope. See Figure 3 for an example of the type of revisions made to each of the cross-sections outside of the RGV-01 project using a 150-ft enforcement zone. Wall heights varied from 1-ft to 10-ft, and side slopes were 4:1, 5:1, 10:1, and 100:1. Wall heights and side slopes that vary from 10-ft and 4:1 are identified in the cross-section description. These variables will change at the final design phase for each project. The enforcement zone within RGV-01 is 75-ft and 150-ft elsewhere. For the RGV-01 project area, the proposed cross-sections were cut using a proposed surface.

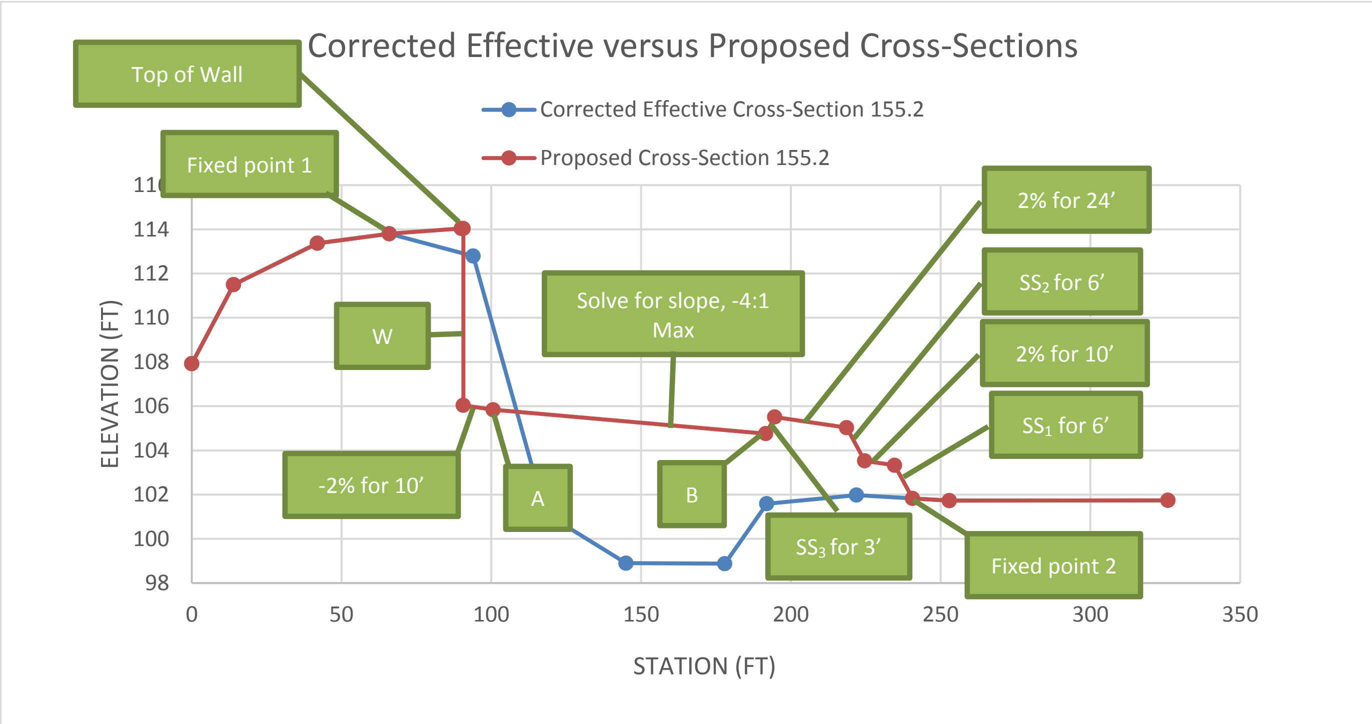

Figure 3: Proposed Cross-section Generation

2.4.0 IMPACTS

Hydraulic impacts are defined by increases in the WSE and deflection of flow from the north overbank to the south overbank. The hydraulic impacts due to WSE increases are calculated as the proposed WSE minus the corrected effective WSE. The hydraulic impacts due to increases in deflection of flows are calculated using the HEC-RAS variables ‘Q Left,’ ‘Q Channel,’ and ‘Q Right,’ per USIBWC guidance. These variables represent, respectively, flow in the left overbank, flow in the main channel, and flow in the right overbank. For each cross-section, the discharge on the MX side (QMX) is calculated as half the flow in the main channel plus the flow in the right overbank. Similarly, for each cross-section, the discharge on the US side (QUS) is calculated as half the flow in the main channel plus the flow in the left overbank. These calculations are made for both the corrected effective plan and the proposed plan. Finally, the increase in the percent deflection is calculated for each cross-section for MX and for the US. The WSE, velocity (Vel) in ft per second (fps), and discharge rate impacts in cfs are shown below in Table 7. The river stations listed with asterisks are interpolated and river stations with red font identify locations with the highest changes in values.

Table 7: Proposed Hydraulic Impacts

River Station	WSE (ft) ∆	Vel (fps) ∆	Proposed Condition QUS (cfs)	Proposed Condition QMX (cfs)	Existing Condition QUS (cfs)	Existing Condition QMX (cfs)	Deflection US (cfs)	Deflection MX (cfs)	Percent Deflection US	Percent Deflection MX
186	0.01	0.00	53545	181455	53556	181444	-11	11	-0.02%	0.01%
185.50*	0.01	0.00	93733	141267	93743	141257	-10	10	-0.01%	0.01%
185	0.02	0.00	112865	122135	112878	122122	-13	13	-0.01%	0.01%
184.50*	0.01	0.00	88243	146757	88260	146740	-17	17	-0.02%	0.01%
184	0.02	-0.01	56349	178651	56369	178631	-20	20	-0.04%	0.01%
183.80*	0.01	-0.01	60876	174124	60890	174110	-14	14	-0.02%	0.01%
183.60*	0.01	0.00	67425	167575	67425	167575	0	0	0.00%	0.00%
183.40*	0.02	-0.01	91295	143705	91297	143703	-2	3	0.00%	0.00%
183.2	0.01	-0.01	107644	127356	107647	127353	-3	3	0.00%	0.00%
183.00*	0.01	0.00	113266	121734	113277	121723	-11	11	-0.01%	0.01%
182.80*	0.02	-0.01	112947	122053	112954	122046	-7	7	-0.01%	0.01%
182.60*	0.02	0.00	114408	120592	114415	120585	-7	7	-0.01%	0.01%
182.4	0.01	-0.01	118283	116717	118288	116712	-5	5	0.00%	0.00%
182.05*	0.01	0.00	107824	127176	107830	127170	-7	7	-0.01%	0.01%
181.70*	0.01	0.00	95473	139527	95479	139521	-6	6	-0.01%	0.00%
181.35	0.02	-0.01	81982	153018	81978	153022	4	-4	0.00%	0.00%
181.01*	0.02	0.00	80793	154207	80790	154210	3	-3	0.00%	0.00%
180.66*	0.01	0.00	88400	146600	88404	146596	-4	4	0.00%	0.00%
180.32	0.01	0.00	95014	139986	95010	139990	4	-4	0.00%	0.00%
180.3	0.01	-0.01	70998	164002	71043	163957	-45	45	-0.06%	0.03%
180.08*	0.02	-0.01	88185	146815	87995	147005	190	-190	0.22%	-0.13%
179.85*	0.02	-0.01	120567	114433	120233	114767	333	-333	0.28%	-0.29%
179.63*	0.01	0.00	133915	101085	133983	101017	-68	68	-0.05%	0.07%
179.4	0.02	0.01	148402	86598	148777	86223	-374	375	-0.25%	0.43%
179.10*	0.02	0.01	156379	78621	156713	78287	-334	334	-0.21%	0.43%
178.80*	0.02	0.00	111239	123761	111533	123467	-294	294	-0.26%	0.24%
178.5	0.02	0.01	120407	114593	120649	114351	-241	241	-0.20%	0.21%
178.23*	0.02	0.00	125141	109859	125246	109754	-105	105	-0.08%	0.10%
177.97*	0.02	0.00	130049	104951	130055	104945	-6	6	0.00%	0.01%

	WSE (ft)	Vel (fps)	Proposed Condition		Existing Condition		Deflection		Percent Deflection	
River Station	Δ	Δ	QUS (cfs)	QMX (cfs)	QUS (cfs)	QMX (cfs)	US (cfs)	MX (cfs)	US	MX
177.7	0.02	-0.01	161146	73854	161132	73868	13	-13	0.01%	-0.02%
177.40*	0.02	-0.01	163471	71529	163474	71526	-3	3	0.00%	0.00%
177.10*	0.02	-0.01	153196	81804	153207	81793	-11	11	-0.01%	0.01%
176.8	0.02	-0.01	140526	94474	140486	94514	40	-40	0.03%	-0.04%
176.40*	0.02	0.00	109738	125262	109936	125064	-198	198	-0.18%	0.16%
176.00*	0.02	-0.02	94573	140427	94405	140595	168	-168	0.18%	-0.12%
175.6	0.02	0.01	49841	185159	50291	184709	-450	449	-0.89%	0.24%
175.27*	0.02	-0.01	88787	146214	88636	146365	151	-151	0.17%	-0.10%
174.93*	0.02	0.00	76613	158387	76774	158226	-160	161	-0.21%	0.10%
174.6	0.03	-0.01	103746	131254	103816	131184	-70	70	-0.07%	0.05%
174.2	0.02	0.00	183544	51456	183665	51335	-121	121	-0.07%	0.24%
174.10*	0.02	0.00	193717	41283	193838	41162	-121	121	-0.06%	0.29%
174	0.02	0.01	207752	27248	207820	27180	-68	68	-0.03%	0.25%
173.33*	0.03	0.00	182159	52841	182266	52734	-107	107	-0.06%	0.20%
172.67*	0.02	-0.01	151611	83389	151598	83402	13	-13	0.01%	-0.02%
172	0.02	0.00	123412	111588	123733	111267	-321	321	-0.26%	0.29%
171.90*	0.03	0.00	90853	144147	90926	144074	-73	73	-0.08%	0.05%
171.8	0.02	0.01	59302	175698	59822	175178	-520	520	-0.87%	0.30%
171.48*	0.03	0.00	55622	179379	55712	179287	-91	91	-0.16%	0.05%
171.15	0.03	-0.01	60337	174663	60242	174758	95	-95	0.16%	-0.05%
170.83*	0.02	-0.01	93582	141418	93593	141407	-11	11	-0.01%	0.01%
170.5	0.01	0.02	117779	117221	117959	117041	-180	180	-0.15%	0.15%
170.38*	0.01	0.03	122384	112616	122632	112369	-248	248	-0.20%	0.22%
170.26	0.01	0.08	153918	81082	154883	80117	-965	965	-0.62%	1.20%
170.02	-0.01	0.02	97629	137371	97806	137194	-177	177	-0.18%	0.13%
169.9	0.00	0.00	94119	140881	94157	140843	-38	38	-0.04%	0.03%
169.83	0.00	0.00	48832	81168	48832	81168	0	0	0.00%	0.00%
169.49	0.00	0.00	60997	69003	60997	69003	-1	1	0.00%	0.00%
169.14	0.00	0.00	65000	65000	65000	65000	0	0	0.00%	0.00%
169.12	0.00	0.00	65000	65000	65000	65000	0	0	0.00%	0.00%

	WSE (ft)	Vel (fps)	Proposed Condition		Existing Condition		Deflection		Percent Deflection	
River Station	Δ	Δ	QUS (cfs)	QMX (cfs)	QUS (cfs)	QMX (cfs)	US (cfs)	MX (cfs)	US	MX
169.1	0.01	0.00	65000	65000	65000	65000	0	0	0.00%	0.00%
168.85	0.00	0.00	74585	55415	74584	55416	1	-1	0.00%	0.00%
168.58	0.00	0.00	82982	47018	82981	47019	1	-1	0.00%	0.00%
168.3	0.00	0.00	72679	57321	72677	57323	2	-2	0.00%	0.00%
168	0.00	0.00	97973	32027	97970	32030	2	-2	0.00%	-0.01%
167.70*	0.00	0.00	90473	39527	90470	39530	2	-2	0.00%	-0.01%
167.4	0.00	0.00	93609	36391	93607	36393	2	-2	0.00%	-0.01%
167	0.00	0.00	67991	62009	67988	62012	3	-3	0.00%	0.00%
166.6	0.00	0.00	79081	50919	79078	50922	3	-3	0.00%	-0.01%
166	0.00	0.00	88494	41506	88486	41514	8	-8	0.01%	-0.02%
165	0.01	0.00	102392	27608	102391	27609	0	0	0.00%	0.00%
163	0.01	0.00	58640	71361	58642	71358	-2	2	0.00%	0.00%
162.1	0.01	0.00	37677	92323	37682	92318	-5	5	-0.01%	0.01%
161.4	0.00	0.00	65709	64291	65712	64288	-4	4	-0.01%	0.01%
161.35	0.00	0.00	73233	56767	73230	56770	2	-2	0.00%	0.00%
161.3	0.01	0.01	65578	64422	65708	64292	-130	130	-0.20%	0.20%
160	0.01	0.00	60962	69038	60966	69033	-4	4	-0.01%	0.01%
159	0.01	0.00	39829	90171	39838	90162	-10	10	-0.02%	0.01%
157.2	0.01	-0.01	97235	32765	97237	32763	-2	2	0.00%	0.01%
157.15	0.01	0.00	79189	50811	79180	50820	10	-10	0.01%	-0.02%
156.93	0.01	0.00	63673	61327	63672	61327	0	0	0.00%	0.00%
156.9	0.01	0.00	64087	60913	64087	60913	0	0	0.00%	0.00%
156.87	0.01	0.00	64416	60584	64416	60584	0	0	0.00%	0.00%
156.84	0.01	0.00	60849	64151	60850	64150	-2	2	0.00%	0.00%
156.7	0.01	0.00	60041	64959	60042	64958	-1	1	0.00%	0.00%
156.6	0.01	-0.01	57447	67553	57450	67550	-3	3	0.00%	0.00%
156.15	0.01	0.00	84475	40525	84456	40544	19	-19	0.02%	-0.05%
155.7	0.01	-0.01	67940	57060	67945	57055	-5	5	-0.01%	0.01%
155.36	0.02	-0.01	70629	54371	70634	54367	-5	5	-0.01%	0.01%
155.2	0.01	0.02	71333	53667	71832	53168	-499	499	-0.70%	0.94%

	WSE (ft)	Vel (fps)	Proposed Condition		Existing Condition		Deflection		Percent Deflection	
River Station	Δ	Δ	QUS (cfs)	QMX (cfs)	QUS (cfs)	QMX (cfs)	US (cfs)	MX (cfs)	US	MX
155.01	0.01	0.00	61844	63156	61849	63151	-5	5	-0.01%	0.01%
154.81	0.01	0.01	37598	87402	38018	86982	-420	420	-1.10%	0.48%
154.6	0.01	0.00	62787	62213	62895	62105	-108	108	-0.17%	0.17%
154.23	0.01	0.01	62430	62570	62586	62414	-156	156	-0.25%	0.25%
153.85	0.01	0.00	50996	74004	51028	73972	-32	32	-0.06%	0.04%
153.61	0.00	-0.01	46188	78812	46204	78796	-16	15	-0.03%	0.02%
153.36	0.01	0.00	46679	78321	46917	78083	-239	239	-0.51%	0.31%
153.08*	0.00	0.01	50029	74971	50147	74853	-119	118	-0.24%	0.16%
152.81*	0.01	0.00	47351	77649	47393	77607	-42	42	-0.09%	0.05%
152.53	0.01	0.00	25642	99358	25635	99365	8	-8	0.03%	-0.01%
152.25*	0.01	0.00	48767	76233	48843	76157	-76	76	-0.15%	0.10%
151.98*	0.01	0.01	53852	71148	53950	71050	-98	98	-0.18%	0.14%
151.7	0.01	0.00	51044	73956	51182	73818	-138	138	-0.27%	0.19%
151.49	0.01	0.01	55680	69320	56009	68991	-329	329	-0.59%	0.48%
151.27	0.00	0.01	70552	54448	70807	54193	-255	255	-0.36%	0.47%
151.25	0.00	0.01	68140	56860	68398	56602	-258	258	-0.38%	0.46%
151.24	0.01	0.00	70824	54176	70957	54043	-134	134	-0.19%	0.25%
150.78	0.01	0.00	57159	67841	57104	67896	55	-55	0.10%	-0.08%
150.31	0.00	0.00	95305	29695	95355	29645	-50	50	-0.05%	0.17%
149.66*	0.01	0.01	84799	40201	84925	40075	-126	126	-0.15%	0.32%
149	0.01	0.01	87871	37129	88048	36952	-178	178	-0.20%	0.48%
148.34*	0.00	0.01	69322	55678	69426	55574	-104	104	-0.15%	0.19%
147.68	0.01	0.00	64014	60986	64143	60857	-129	129	-0.20%	0.21%
147.34*	0.01	0.00	52606	72394	52655	72345	-49	49	-0.09%	0.07%
147.01*	0.00	0.00	53619	71381	53633	71367	-14	14	-0.03%	0.02%
146.67*	0.00	0.00	44916	80084	44935	80065	-19	19	-0.04%	0.02%
146.34*	0.00	0.00	45481	79519	45725	79275	-244	244	-0.53%	0.31%
146	0.00	0.00	37658	87342	37640	87360	17	-17	0.05%	-0.02%
145.67*	0.00	0.01	52412	72588	52614	72386	-202	202	-0.38%	0.28%
145.5	0.00	0.00	57237	67763	57260	67740	-23	23	-0.04%	0.03%

	WSE (ft)	Vel (fps)	Proposed Condition		Existing Condition		Deflection		Percent Deflection	
River Station	∆	∆	QUS (cfs)	QMX (cfs)	QUS (cfs)	QMX (cfs)	US (cfs)	MX (cfs)	US	MX
145.2	0.01	0.13	61019	63981	61218	63782	-199	199	-0.32%	0.31%
145	0.00	0.00	73303	51697	73427	51573	-123	123	-0.17%	0.24%
144.7	0.01	0.03	51931	73069	51005	73995	926	-926	1.82%	-1.25%
144.55	0.00	0.00	34798	90202	34753	90247	46	-46	0.13%	-0.05%
144	0.00	0.01	60485	64515	60607	64393	-122	122	-0.20%	0.19%
143.5	0.00	0.01	67482	57518	67756	57244	-274	274	-0.40%	0.48%
143.25	0.00	0.00	45796	79204	45833	79167	-37	37	-0.08%	0.05%
143	0.00	0.00	79453	45547	79531	45469	-78	78	-0.10%	0.17%
142.5	0.00	-0.01	76791	48209	76725	48275	66	-66	0.09%	-0.14%
142	0.00	0.00	77977	47023	77987	47013	-10	10	-0.01%	0.02%
141.9	0.00	-0.01	60818	64182	60753	64247	64	-64	0.11%	-0.10%
141.5	0.00	0.00	50488	74512	50664	74336	-177	177	-0.35%	0.24%
140.74	0.00	-0.01	27844	97156	27635	97365	209	-209	0.76%	-0.21%
140	0.00	0.00	45839	79161	45850	79150	-11	11	-0.02%	0.01%
139.85	0.00	-0.01	35983	89017	35881	89119	102	-102	0.29%	-0.11%
139.57*	0.00	0.00	38859	86141	38856	86144	3	-3	0.01%	0.00%
139.29*	0.00	0.00	43358	81642	43297	81703	61	-61	0.14%	-0.08%
139.01	0.00	0.00	25693	99307	25628	99372	65	-65	0.25%	-0.07%
138.69*	0.00	0.00	21411	103589	21388	103612	23	-23	0.11%	-0.02%
138.36	0.00	0.00	28820	96180	28806	96194	14	-14	0.05%	-0.01%
138.04*	0.00	0.00	26043	98957	26014	98986	29	-29	0.11%	-0.03%
137.71	0.00	0.00	37687	87313	37647	87353	40	-40	0.11%	-0.05%
137.43*	0.00	0.00	38022	86978	37998	87002	24	-24	0.06%	-0.03%
137.14	0.00	0.00	46927	78073	46959	78041	-32	32	-0.07%	0.04%
136.8	0.00	-0.01	31482	93518	31359	93641	123	-123	0.39%	-0.13%
136.2	0.00	0.00	27872	97128	27727	97273	146	-146	0.52%	-0.15%
136	0.00	0.00	28665	96335	28666	96334	0	0	0.00%	0.00%
135.5	0.00	0.00	29201	95799	29161	95839	41	-41	0.14%	-0.04%
135	0.00	0.00	28944	96056	28945	96055	0	0	0.00%	0.00%
134.65	0.00	0.00	28979	96021	28979	96021	0	0	0.00%	0.00%

	WSE (ft)	Vel (fps)	Proposed Condition		Existing Condition		Deflection		Percent Deflection	
River Station	Δ	Δ	QUS (cfs)	QMX (cfs)	QUS (cfs)	QMX (cfs)	US (cfs)	MX (cfs)	US	MX
134.33*	0.00	0.00	35157	89843	35157	89843	0	0	0.00%	0.00%
134.02*	0.00	0.00	46371	78629	46372	78628	0	0	0.00%	0.00%
133.70*	0.00	0.00	47503	77497	47503	77497	0	0	0.00%	0.00%
133.38*	0.00	0.00	52741	72259	52741	72259	0	0	0.00%	0.00%
133.07*	0.00	0.00	63164	61836	63164	61836	0	0	0.00%	0.00%
132.75	0.00	0.00	79598	45402	79598	45402	0	0	0.00%	0.00%
132.46*	0.00	0.00	62539	62461	62539	62461	0	0	0.00%	0.00%
132.18*	0.00	0.00	49706	75294	49706	75294	0	0	0.00%	0.00%
131.89*	0.00	0.00	41498	83502	41498	83502	0	0	0.00%	0.00%
131.6	0.00	-0.01	31319	93681	31319	93681	0	0	0.00%	0.00%
131.35	0.00	0.00	45864	79136	45864	79136	0	0	0.00%	0.00%
130.93	0.00	0.00	55914	69086	55915	69085	0	0	0.00%	0.00%
130.51	0.00	0.00	54495	70505	54494	70506	1	-1	0.00%	0.00%
129.3	0.00	0.00	10244	9756	10244	9756	0	0	0.00%	0.00%
129.27	0.01	0.00	12413	7587	12413	7587	0	0	0.00%	0.00%
129.23	0.00	0.00	10000	10000	10000	10000	0	0	0.00%	0.00%
129.22	0.00	0.00	10000	10000	10000	10000	0	0	0.00%	0.00%
129.216	0.00	0.00	10000	10000	10000	10000	0	0	0.00%	0.00%
129.214	0.00	0.00	10000	10000	10000	10000	0	0	0.00%	0.00%
129.213	0.00	0.00	10000	10000	10000	10000	0	0	0.00%	0.00%
129.212	0.00	0.00	10000	10000	10000	10000	0	0	0.00%	0.00%
129.211	0.00	0.00	10000	10000	10000	10000	0	0	0.00%	0.00%
129.21	0.00	0.00	10000	10000	10000	10000	0	0	0.00%	0.00%
129.2	0.00	0.00	12210	7790	12210	7790	0	0	0.00%	-0.01%
129.03	0.00	0.00	10040	9960	10040	9960	0	0	0.00%	0.00%
128.5	0.00	0.00	9081	10919	9081	10919	0	0	0.00%	0.00%
128.23*	0.00	0.00	10164	9836	10164	9836	0	0	0.00%	0.00%
127.97*	0.00	0.00	10291	9709	10291	9709	0	0	0.00%	0.00%
127.7	0.00	0.01	10584	9417	10592	9408	-9	9	-0.08%	0.09%
127.4	0.00	0.01	14431	5569	14463	5537	-32	32	-0.22%	0.57%

	WSE (ft)	Vel (fps)	Proposed Condition		Existing Condition		Deflection		Percent Deflection	
River Station	∆	∆	QUS (cfs)	QMX (cfs)	QUS (cfs)	QMX (cfs)	US (cfs)	MX (cfs)	US	MX
127.05*	0.00	-0.01	12029	7971	12024	7976	5	-5	0.04%	-0.06%
126.7	0.00	0.01	11345	8655	11348	8652	-3	3	-0.03%	0.04%
126.35*	0.00	0.00	6600	13400	6599	13401	1	-1	0.02%	-0.01%
126.00*	0.00	0.00	7357	12643	7356	12644	1	-1	0.01%	-0.01%
125.65*	0.00	0.00	7721	12279	7721	12279	1	-1	0.01%	-0.01%
125.3	0.00	0.00	8145	11855	8143	11857	2	-2	0.02%	-0.01%
125	0.00	0.00	8795	11205	8794	11206	0	0	0.01%	0.00%
124.80*	-0.01	0.00	7278	12722	7270	12730	7	-7	0.10%	-0.06%
124.60*	0.00	0.00	8683	11317	8675	11325	7	-7	0.09%	-0.07%
124.4	0.00	0.00	10190	9810	10184	9816	6	-6	0.06%	-0.06%
124.20*	0.00	0.01	8723	11277	8723	11277	0	0	0.00%	0.00%
124.00*	0.00	0.00	8069	11931	8068	11932	1	-1	0.01%	-0.01%
123.8	0.00	0.00	9354	10646	9353	10647	1	-1	0.01%	0.00%
123.48*	0.00	0.00	9642	10358	9641	10359	1	-1	0.01%	-0.01%
123.15	0.00	0.00	12716	7284	12718	7282	-2	2	-0.02%	0.03%
122.83*	0.00	0.00	11599	8401	11599	8401	0	0	0.00%	0.00%
122.5	-0.01	0.00	10288	9712	10287	9713	1	-1	0.01%	-0.01%
121.98*	0.00	0.00	8738	11262	8737	11263	1	-1	0.01%	-0.01%
121.46	0.00	0.00	8730	11270	8729	11271	1	-1	0.01%	-0.01%
121.13*	0.00	0.00	8867	11133	8866	11134	0	0	0.01%	0.00%
120.8	-0.01	0.00	9782	10218	9778	10222	4	-4	0.04%	-0.04%
120.7	-0.01	0.00	9911	10089	9909	10091	2	-2	0.02%	-0.02%
120.62	-0.01	0.00	10010	9990	10010	9990	0	0	0.00%	0.00%
120.59	0.00	0.01	9986	10014	9986	10014	0	0	0.00%	0.00%
120.5	-0.01	0.00	9731	10269	9730	10270	1	-1	0.01%	-0.01%
120.4	0.00	0.00	9513	10487	9512	10488	1	-1	0.01%	-0.01%
120.39*	-0.01	0.00	11079	8921	11080	8920	-1	1	-0.01%	0.01%
120.38	-0.01	0.00	11154	8846	11156	8844	-2	2	-0.02%	0.03%
120.07*	0.00	0.00	10570	9430	10571	9429	-1	1	-0.01%	0.01%
119.75*	0.00	0.00	10531	9469	10532	9468	0	1	0.00%	0.01%

River Station	WSE (ft) Δ	Vel (fps) Δ	Proposed Condition QUS (cfs)	Proposed Condition QMX (cfs)	Existing Condition QUS (cfs)	Existing Condition QMX (cfs)	Deflection US (cfs)	Deflection MX (cfs)	Percent Deflection US	Percent Deflection MX
119.44*	-0.01	0.00	10751	9249	10751	9249	0	0	0.00%	0.00%
119.12*	0.00	0.01	9231	10769	9230	10770	2	-2	0.02%	-0.01%
118.81	0.00	0.00	7816	12184	7813	12187	3	-3	0.04%	-0.03%
118.50*	-0.01	0.00	10751	9249	10750	9250	1	-1	0.01%	-0.01%
118.18*	0.00	0.00	11111	8889	11111	8889	0	0	0.00%	0.00%
117.87	-0.01	0.00	11930	8070	11933	8067	-3	3	-0.03%	0.04%
117.54*	0.00	0.00	11670	8330	11673	8327	-3	3	-0.03%	0.04%
117.2	-0.01	0.00	10486	9514	10481	9519	4	-4	0.04%	-0.05%
116.5	0.00	-0.02	10629	9371	10557	9443	72	-72	0.68%	-0.76%
116.1	0.00	0.00	8316	11684	8316	11684	0	0	0.00%	0.00%
115.7	0.00	0.00	11479	8521	11479	8521	0	0	0.00%	0.00%
115.45*	0.00	0.00	9236	10764	9236	10764	0	0	0.00%	0.00%
115.2	0.00	0.00	9492	10508	9492	10508	0	0	0.00%	0.00%
115	0.00	0.00	9179	10821	9179	10821	0	0	0.00%	0.00%
114.8	0.00	0.00	11813	8187	11813	8187	0	0	0.00%	0.00%
114.65	0.00	0.00	13249	6751	13249	6751	0	0	0.00%	0.00%
114.47*	0.00	0.00	9878	10122	9878	10122	0	0	0.00%	0.00%
114.28*	0.00	0.00	10487	9513	10487	9513	0	0	0.00%	0.00%
114.1	0.00	0.00	10828	9172	10828	9172	0	0	0.00%	0.00%
113.73*	0.00	0.00	11039	8961	11039	8961	0	0	0.00%	0.00%
113.37*	0.00	0.00	14289	5711	14289	5711	0	0	0.00%	0.00%
113	0.00	0.00	12367	7633	12367	7633	0	0	0.00%	0.00%
112.73*	0.00	0.00	12326	7674	12326	7674	0	0	0.00%	0.00%
112.47*	0.00	0.00	10723	9277	10723	9277	0	0	0.00%	0.00%
112.2	0.00	0.00	10582	9418	10582	9418	0	0	0.00%	0.00%

*Interpolated Cross-Sections   Red Font – Locations with highest changes in values

The maximum WSE change is an increase of 0.03 ft at cross-sections 174.6 and 171.15, and at interpolated sections 173.33, 171.90, and 171.48. The maximum change in velocity is 0.08 ft per second at section 170.26. The maximum deflection on the QUS is an increase of 1.82%, and on the QMX, is an increase of 1.20%. These occur at River Stations 144.7 and 170.26. Therefore, modeling results suggest changes to the floodplain and WSEs, as a result of the wall construction, are within the allowable thresholds set by USIBWC.

2.5.0 FREEBOARD

Finally, locations along RGV-03 and RGV-04 have been identified where 3-ft of freeboard have not been met for the proposed condition. These include the following cross-sections in Table 8:

Table 8: Cross-Sections Showing Less than Three Feet of Freeboard for the Proposed Condition

Cross Section ID	Comment	Design WSE (ft)	Proposed Levee Elev (ft)	Available Freeboard	Project Area
180.32	New XS	132.90	134.88	1.98	RGV-04
178.5	USIBWC XS	132.00	132.54	0.56	RGV-04
171.15	USIBWC XS	128.18	128.71	0.53	RGV-03
170.26	USIBWC XS	125.46	126.53	1.07	RGV-03
169.9	New XS	122.23	123.55	1.32	RGV-03

Upon final design drawings for this area, 3-ft of freeboard above the design WSE will be provided.

2.5.1 MODEL COMPARISONS

Because the levee elevations in this area did not meet the 3-ft freeboard requirement in the proposed condition, additional comparisons were made using the 2003 model, the 2003 model in NGVD88, the 2008 model/duplicate effective model, the elevations provided by the USIBWC (see Attachment D) for the Mission Levee, and the corrected effective model. Interpolated cross-sections are not included in the comparison, and cross-sections 180.3, 179.4, 176.8, 175.6, 174.6, 174, 172, 170.5, 170.02, located between 180.32 and 169.9, are shown, but not compared because the 3-ft freeboard criterion is met at those locations.

Differences exist between the 2003 model and the 2008/duplicate effective model that may explain the differences between the results. The 2003 model contains cross-sections that were surveyed in 1990, 1992, and 2001. The 2008 model shows the same cross-sections, but with added sections surveyed in 2007. Blocked obstructions were shown in the 2003 model, but more were added and all were modified in the 2008 model. Levees and ineffective flow areas were not used in the 2003 model and both were added in the 2008 model.

See Table 9: 2003 Model NGVD88 and 2008/Duplicate Effective Model Comparison for the differences in WSEs between the 2003 model converted to NGVD88, and the 2008 model. Additionally, Table 9 shows the WSEs, plus 3-ft, to determine what would have been the minimum proposed top of levee elevation (TOLE), using any of the three models. 0.36-ft was subtracted from the 2003 model to convert it to NGVD88. The acronym DNE (Does Not Exist) is used to show the cross-sections used in the proposed and corrected effective models that do not exist in the earlier models.

Table 9: 2003 Model NGVD88 and 2008/Duplicate Effective Model Comparison

Cross-Section ID	2003 Model (Mean Sea Level)		2003 Model NGVD88 = 2003 Model (Mean Sea Level – 0.36')		2008 Model/Duplicate Effective	
	WSE (ft)	WSE + 3 (ft)/ Min. TOLE	WSE (ft)	WSE + 3 (ft) / Min. TOLE	WSE (ft)	WSE + 3 (ft) / Min. TOLE
180.32	DNE	DNE	DNE	DNE	DNE	DNE
180.3	Meets 3-foot Freeboard Requirement					
179.4	Meets 3-foot Freeboard Requirement					
178.5	131.06	134.06	130.7	**133.7**	129.65	132.65
177.7	DNE	DNE	DNE	DNE	129.37	132.37
176.8	Meets 3-foot Freeboard Requirement					
175.6	Meets 3-foot Freeboard Requirement					
174.2	DNE	DNE	DNE	DNE	127.17	130.17
174	Meets 3-foot Freeboard Requirement					
172	Meets 3-foot Freeboard Requirement					
171.8	127.6	130.6	127.24	**130.24**	126.42	129.42
171.15	DNE	DNE	DNE	DNE	126.18	129.18
170.5	Meets 3-foot Freeboard Requirement					
170.26	DNE	DNE	DNE	DNE	123.94	126.94
170.02	Meets 3-foot Freeboard Requirement					
169.9	DNE	DNE	DNE	DNE	DNE	DNE

Only two of the cross-sections identified as not meeting the 3-ft freeboard requirement in the corrected effective geometry are included in the 2003 model. The 2003 NGVD88 model shows the higher elevations over the 2008 model and are highlighted in bold above. As can be seen in the following Table 10, one of these elevations is also higher than the TOLE data obtained from the USIBWC for the Mission Levee.

To compare the levee elevations in the cross-sections with the levee elevations listed in the Mission Levee tables, the northings and eastings listed in the Mission Levee table were matched to the northings and eastings of the levee location in the cross-sections. See Table 10 for a TOLE comparison between the models and the Mission Levee.

Table 10: TOLEs compared between 2003 and Corrected Effective Model, and Mission Levee

	2003 Model NGVD88		Corrected Effective	Mission Levee		TOLE
Cross-Section	WSE (ft)	WSE + 3'/ **Min. TOLE**	TOLE (ft)	Station	TOLE	Highest Value?
180.32	DNE	DNE	134.64	385+00	**134.76**	Mission Levee
180.3	Meets 3-foot Freeboard					
179.4	Meets 3-foot Freeboard					
178.5	130.7	**133.7**	132.23	269+00	133.21	2003 Model
177.7	DNE	DNE	**134.24**	259-00	132.81	Corrected Effective
176.8	Meets 3-foot Freeboard					
175.6	Meets 3-foot Freeboard					
174.2	DNE	DNE	**132.04**	162+00	130.88	Corrected Effective
174	Meets 3-foot Freeboard					
172	Meets 3-foot Freeboard					
171.8	127.24	130.24	**131.22**	103+00	129.88	Corrected Effective
171.15	DNE	DNE	**128.47**	60+00	127.39	Corrected Effective
170.5	Meets 3-foot Freeboard					
170.26	DNE	DNE	**126.29**	30+00	125.18	Corrected Effective
170.02	Meets 3-foot Freeboard					
169.9	DNE	DNE	123.31	0+00	**124.76**	Mission Levee

The existing levee elevations used in the corrected effective geometry are highest everywhere except at the upstream-most cross-section, downstream-most cross-section, and one cross-section in between, where the freeboard requirement was not met.

2.6.0 CONCLUSIONS

The proposed floodwall, within the project parameters, will be designed such that 44 CFR 65.10 requirements will be met. This includes freeboard criteria, structural design of the wall and foundation, and an Operations and Maintenance Plan. In addition, the levee design will not impact the existing Base Flood Elevations or floodplain limits. USIBWC flow deflection and WSE criterion is also met and demonstrated by the 1-D floodplain analysis.

3.0 SECTION 3: 2-D MODELING ANALYSIS FOR NON-LEVEE AREAS

3.1.0 INTRODUCTION

The following section outlines the procedures implemented for the impact analysis of the 63-miles of proposed bollard wall along the Rio Grande from Falcon Dam to Penitas in Texas.

3.2.0 HYDROLOGIC ANALYSIS

The hydrologic analysis for this report was limited to comply with the 1970 Agreement between the US and MX, Minute 238 (Reference 26). In accordance to the agreement, the greatest measured historical discharge at the River was recorded during Hurricane Beulah in September 1967 as shown in table Table 11. The agreement also establishes the design discharge to a flow rate of 250,000 cfs at Rio Grande City. Further discussion on the calibration and design discharge rates is provided in sections 3.3.6 and 3.3.8 in this report.

Table 11: Hurricane Beulah Historical Discharges

Geographical Location	Location with Respect to Rio Grande City Gage Station	Hurricane Beulah Discharge Rate (cfs)
Rio Grande City, Rio Grande	-	220,000
Ciudad Mier, Rio Alamo	27 Miles Upstream	86,500
Ciudad Camargo, Rio San Juan	4 Miles Upstream	166,000
Falcon Dam Outlet	39 Miles Upstream	18.0

3.3.0 HYDRAULIC ANALYSIS

This section discusses the methodology and procedures used to develop the hydraulic model and analysis.

3.3.1 MODELING SOFTWARE

USACE's Hydrologic Engineering Center River Analysis System, HEC-RAS 5.0.3 September 2016 (Reference 20), was used for the analysis.

3.3.2 GRID SIZE AND 1-DIMENSIONAL (1-D) CHANNEL APPROACH

HEC-RAS supports simultaneous 2-D and 1-D models within a single interface, performing calculation iterations between 2-D and 1-D components. For this RGV-63 model, the left and right overbanks (looking downstream) for the Rio Grande are modeled using the 2-D approach and the perennial channel is represented using the 1-D approach.

The 1-D and 2-D components are connected using lateral structures. These structures use the weir equation to exchange flows between the 1-D component and the 2-D mesh. In accordance to the HEC-RAS 2-D Manual (Reference 32), the recommended weir coefficients for "non-elevated overbank terrain" range between 0.2 to 0.5. Because of test runs, the most stable coefficient used in this projects is 0.2. A total of 16 lateral structures was used to exchange flows between each of the 2-D meshes in the floodplain.

HEC-RAS 2-D models can contain multiple computational meshes, each composed of irregular-shaped grids of up to eight-sided cells. In this project, the floodplain surrounding the Rio Grande is agricultural in nature and flat; therefore, a maximum 150-ft resolution was deemed appropriate for the model. Areas requiring additional detail at significant features were added to the meshes by using breaklines and internal 2-D connections.

Smaller resolution grids were added to the mesh using hand-drawn and imported breaklines that can be placed anywhere within the mesh, representing important at-grade topographical features such as roads, abandoned meanders, proposed wall alignment and other features that impact flow direction. The mesh is recomputed using these breaklines, resulting in finer resolution around the desired features.

Internal 2-D connections are used within the model to represent limits of study, to elevate a roadway, and to represent the bollard wall in the proposed condition. These are placed by converting breaklines into internal 2-D connections. Limits of study are represented by raising the elevation of the terrain, using internal 2-D connections placed at the confluence of tributaries along the Rio Grande and locations where the flow ponds in the floodplain. Ponding in the floodplain can be extensive and result in additional numerical computational overhead for the model. For this reason, and the extensive run times, additional boundaries were placed in MX to improve run times, resulting in more conservative results as this volume is routed downstream. The elevated terrain then acts as a barrier to flow (i.e. against backwater entering tributaries), thereby reducing the amount of flow attenuation downstream. See section 3.3.6 for the discussion of the revisions made to the International Roadway on the Mexican side, and section 3.3.9 for the modeling of the bollard wall. The existing and proposed conditions contain the same limits of study and revision to the roadway. Only the proposed condition reflects the bollard wall.

Because the Rio Grande consists of many tight meanders, the 1-D channel is simulated using cross-sections spaced at approximately 600-ft intervals, with a width corresponding to the perennial main channel. Two bridges are represented in the 1-D channel: Roma Bridge, located 20 miles downstream of Falcon Dam, and Rio Grande City Bridge, located 40 miles downstream of Falcon Dam. As-builts were not available for the bridge modeling.

Modeling parameters were based on field photographs and an approved 1-D calibrated model, discussed further in section 3.3.6.

3.3.3 BOUNDARY CONDITIONS

The boundary conditions are applied upstream, downstream, and laterally. The upstream boundary condition consists of quasi-steady inflow hydrographs presented in sections 3.3.6 and 3.3.9. A quasi-steady state hydrograph is applied at the mouth of the dam instead of an unsteady state, because it is intended to represent a multi-day, steady release from the dam and account for the uncertainty of the reach hydrology. The quasi-steady inflow hydrograph for Falcon Dam is located at cross-section river station 477257.8 with no inflow hydrographs entering the 2-D areas. The downstream boundary condition is set to normal depth at river station 187.58 and for both 2-D overbank areas. The slope, applied to all the normal depth calculations, is 0.0002 ft/ft. The lateral boundaries and the inflow hydrograph values are discussed in section 3.3.6 Model Calibration and section 3.3.3 Design Flows and Existing Conditions. Limits of study are also discussed in section 3.3.2.

3.3.4 NUMERICAL STABILITY TOLERANCE VALUES

Some computational settings were adjusted depending on the performance of the model. Since the thresholds provided by USIBWC are within three significant figures of a ft unit of measurement, the calculations were set to hundredths of a ft, where possible.

For 1-D modeling, the water surface calculation tolerance and the storage area elevation tolerance were set to 0.05 ft. For the 2-D and 2-D/1-D tolerances, the WSE and the volume tolerance were set to 0.1 ft. The maximum number of iterations was set at 40. Ten warm-up time steps were allotted, the lateral structure flow stability factor was set to 3, and the weir flow submergence decay exponent was set to 3. The other 1-D and all of the 2-D parameters were set to the default. The maximum iterations between 1-D and 2-D were set to 20, and the minimum flow tolerance was set to 10 cfs. The percentage of flow and water surface tolerances were set to the default.

To help with model stablity, the computational time steps were balanced between model run time and stability. For the calibration, existing, and proposed condition, the time step was set to 10 seconds.

3.3.5 RIO GRANDE MAIN CHANNEL BATHYMETRY

The terrain used for modeling is composed of 2007 and 2017 datum, provided by USIBWC. The 2007 terrain surface extends from MX into the US, and bathymetry was not included. To address this issue, a combination of two methods was used to represent the river bottom. The first method consisted of using an earlier Rio Grande HEC-RAS 1-D Model (Falcon Dam to Penitas 1991-1992) geometry to develop and interpolate the bottom of the river using HEC-RAS tools. The second digital terrain incorporated an acceptable bathymetry, approved by the USIBWC in 2017. The terrain was sewn together using HEC-RAS tools. Datum and elevations were verified to be consistent among all the surfaces received. The horizontal datum is NAD 1983, State Plane Texas South 4205 Feet, and the vertical datum is NAVD88.